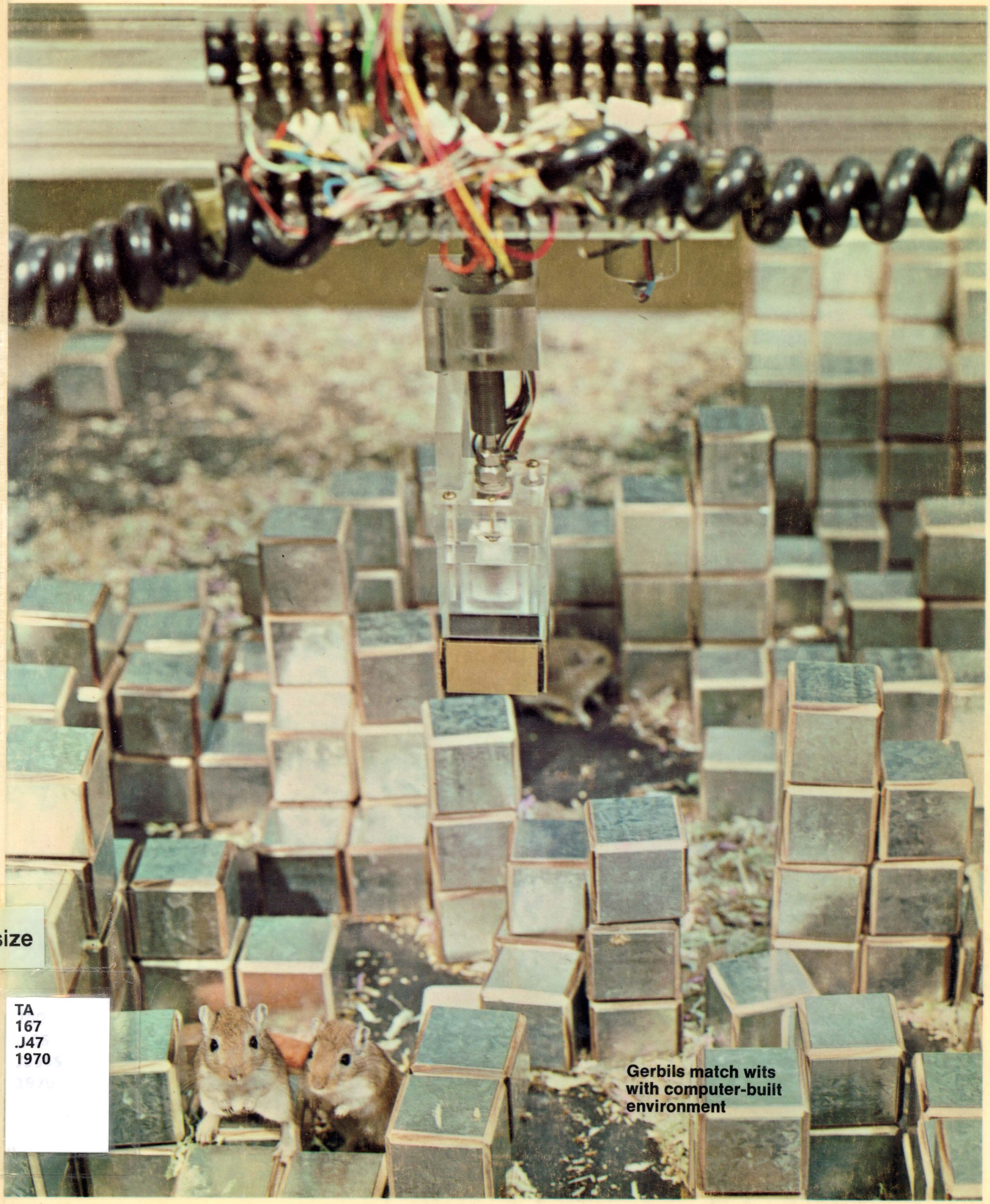
SOFTWARE

Information technology: its new meaning for art



Gerbils match wits with computer-built environment

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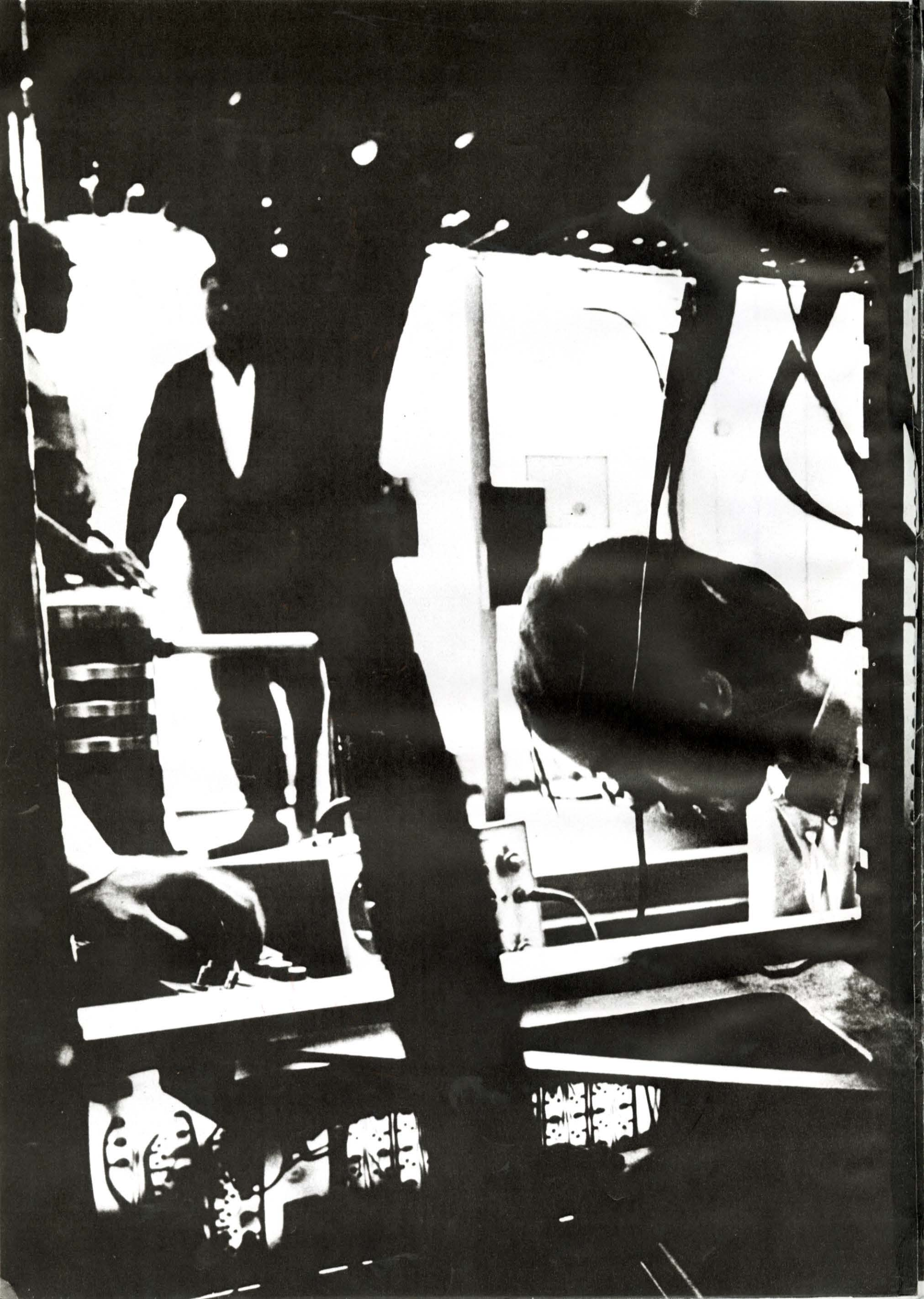

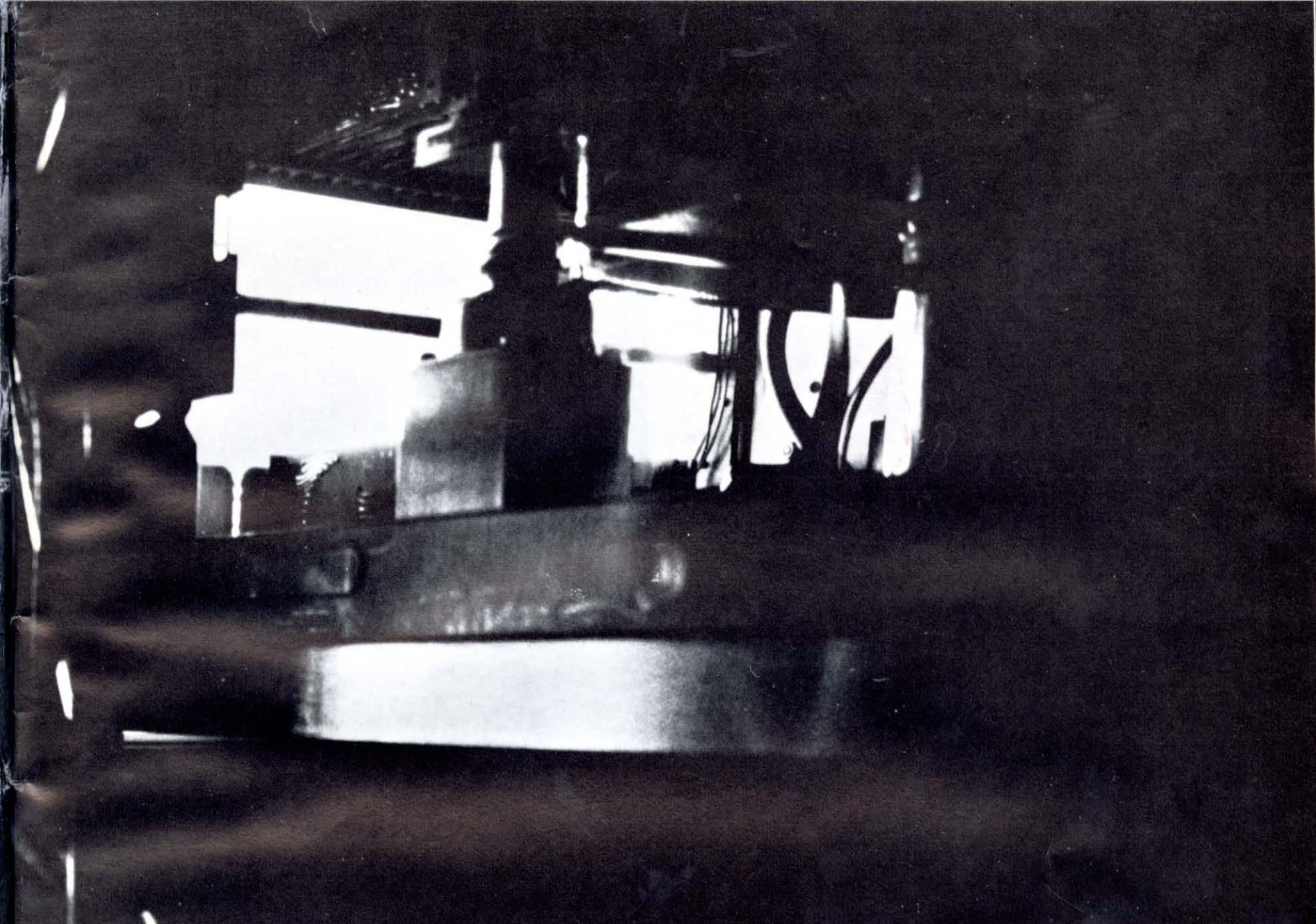

SOFTWARE, an exhibition
sponsored by American Motors Corporation

The Jewish Museum
September 16 through November 8, 1970

The Smithsonian Institution
December 16 through February 14, 1971

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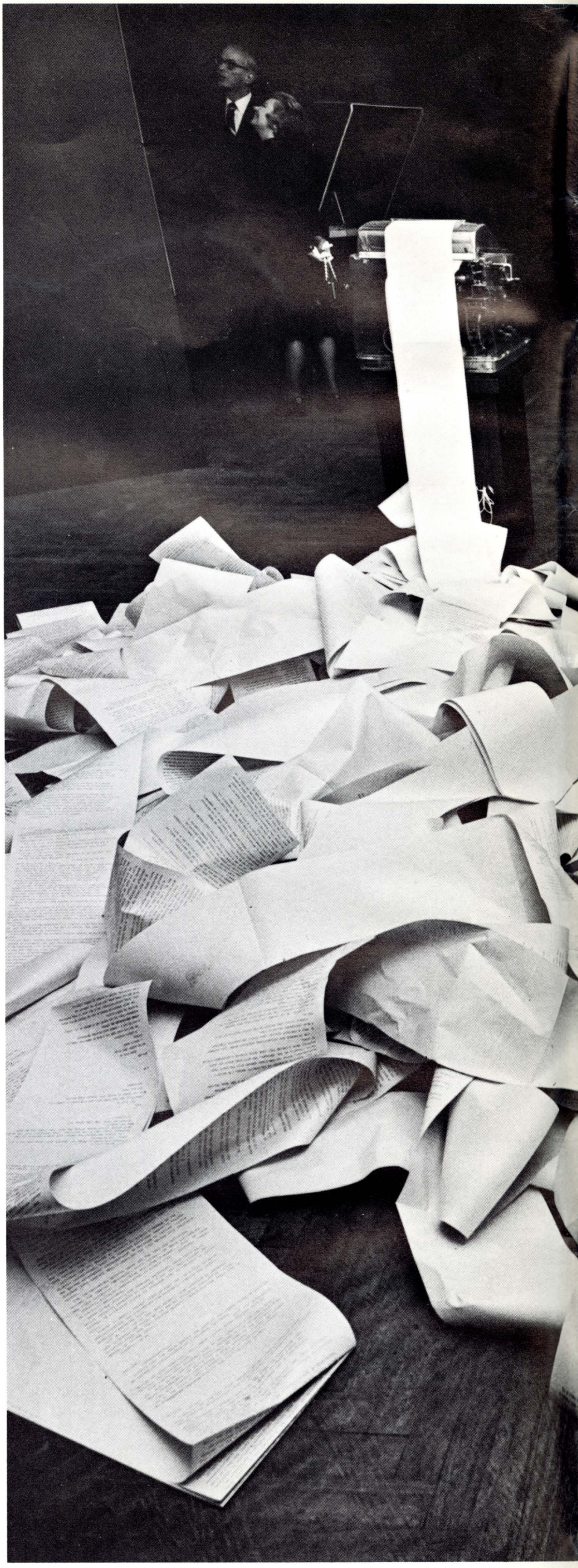
Ruder & Finn Fine Arts



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Software is an exhibition which utilizes sophisticated communications technology, but concentrates on the interaction between people and their electronic and electromechanical surroundings. This is the same exploration, in human factors, which we use in the engineering design of our automobiles as a human environment.

This exhibition encourages artists to use the medium of electronic technology in challenging and unconventional ways. The link between art and science, which the artists in *Software* are examining, is the same link we must explore and strengthen in our automotive styling and engineering.

Because of our continuing interest in people, in technological achievement, and in the advancement of modern art forms, our involvement in *Software* has been both rewarding and stimulating.

Roy D. Chapin, Jr., Chairman
American Motors Corporation

Director Karl Katz

Introduction

Shortly after assuming Directorship of The Jewish Museum, New York, I envisaged mounting a show which would have a computer and cybernetic orientation. Some months later after a planned showing of an existing exhibition was ruled out I had the good fortune of hearing, then reading and finally meeting Jack Burnham. Jack's ideas about a *Software* show confirmed my feelings that we should mount it and that *Software* would be unlike any exhibition ever done. Naturally, in such a complicated and costly endeavor the Museum had to find interested and cooperative partners. The American Motors Corporation and The Smithsonian Institution filled this need when they came to our aid in sponsorship and creative involvement.

So many individuals have concerned themselves with this major manifestation that listing them all would be impossible —the inevitable inadvertent omission of one would "throw it off balance". (I've learned this from computers; it's easier to debug a machine than an individual).

However, I would miss a unique opportunity if I did not single out some of the people who worked on a day to day basis to see *Software* become a reality.

Joanne Lupton of Ruder & Finn Fine Arts has been in the front lines and has braved the animal as well as the electronics world by handling artists, computer programmers, and gerbils. To Joanne I offer my sincere thanks. Theodor H. Nelson who is Technical Advisor and James Mahoney, Exhibition Designer for The Smithsonian, took a show that was essentially a blueprint and helped make it a full scale, three dimensional, attractive installation.

Let me extend my gratitude as well to The American Motors Corporation whose William McNealy, Roy D. Chapin, Jr. and William Luneburg acted on inspiration and gave us the confidence and backing that we needed, and to Nina Kaiden Wright for creating the liaison.

Frank A. Taylor of The Smithsonian Institution showed vision by making The Smithsonian a partner in *Software* with The Jewish Museum.

Others at The Smithsonian also supported the show from the outset: Dr. Joshua Taylor and Mrs. Adelyn Breeskin, Dorothy Van Arsdale, and Deborah Bretzfelder for her help as Assistant Exhibit Designer.

Thanks too to Judith Burnham, Catalogue Coordinator, Robert Jakob, Catalogue Designer, and to Les Levine who helped develop the concept for the catalogue. I also would like to thank Caroline Lerner for all her assistance.

A large number of corporations have given us essential materials, expertise, and time—without their help it would have been impossible to create this exhibition.

Digital Equipment Corp., Maynard, Mass. PDP-8 Time Share Computer;
Tonus, Inc., Newton Highlands, Mass. Arp Electronic Music Synthesizer;
3M Company, St. Paul, Minnesota, Thermofax Machine Color-in-Color Machine, Color Processor;
Interdata, Inc., Oceanport, N. J., MOD 3 Computer for *Seek*
Mohawk Data Systems, Maynard, Mass. Lineprinter;
Kalart Victor Corp., Plainville, Conn.;
Telebeam Projector used to display Hans Haacke's exhibition statistics;
Information Displays, Inc., Mt. Kisco, N.Y. IDIIOM Display System;
Acoustic Research, Inc., Cambridge, Mass. Amplifiers and Speakers
The following corporations loaned terminals:
Atlantic Technology Corp., Somerspoint, N. J.
Computek, Inc., Cambridge, Mass.
Computer Displays, Inc., Waltham, Mass.
Computer Terminal Corp., New York City
Delta Data Systems Corp., Cornwells Heights, Pa.
Infoton, Inc., Burlington, Mass.
Tektronix, Inc., Beaverton, Oregon

Foster & Kleiser provided a billboard for the Kosuth piece, and The Tumblebrook Farms, Brant Lake, N.Y., a contribution of gerbils.

In making the various Van Schley movies possible, Dr. Sanford D. Greenberg, EDP Technology, Inc. made a very helpful donation. The School of Art of The Art Institute of Chicago made a donation towards the 3M piece. Thanks also to our Board member Lawrence A. Tisch for his contribution, and Mrs. Emil Rogers for the contribution towards Antin's piece.

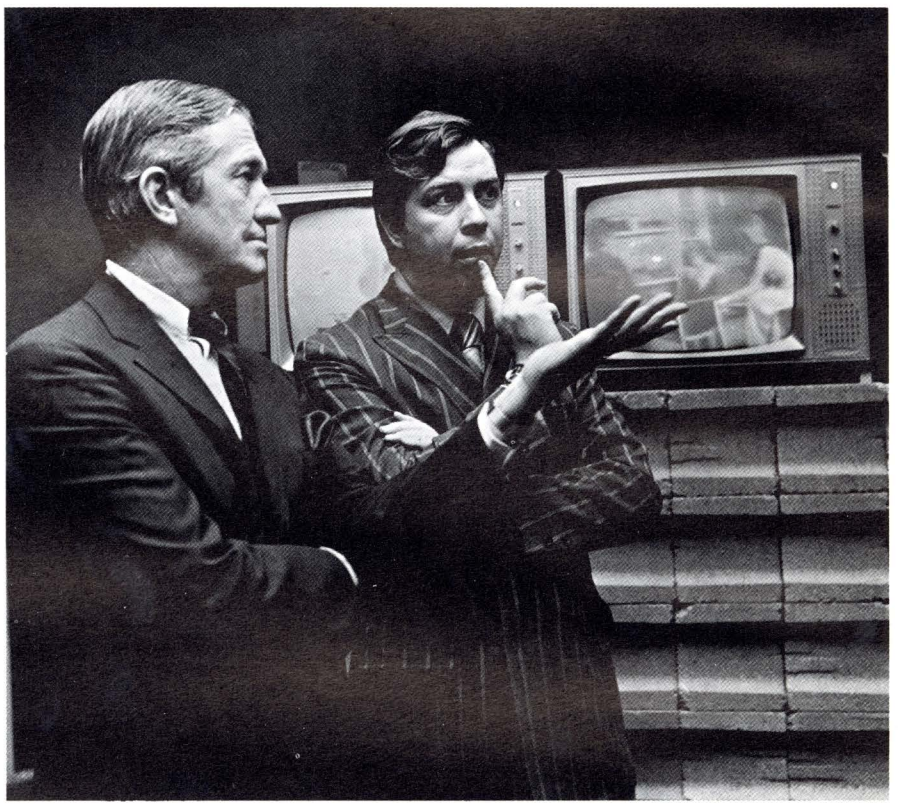
Valuable advice came from Dr. Gustave Rath for his Systems analysis, Oliver Selfridge of ATI, Skip King as an organization consultant, and the R.E.S.I.S.T.O.R.S.; Susan Hartnett, Joan Jonas, "Zeke" Seligsohn and Bruce Gildchrist developed the exhibition in its earliest phase; Ann Doherty, Susan Goodman, and Eva Saaremaa of The Jewish Museum helped at a later date. The Jewish Museum aides came to our rescue in their being available during the duration of the show. In the early stages of the exhibition artists too numerous to mention were contacted. Their initial work helped shape the show and gave us direction. Though many are not in *Software,* all of them merit our thanks for their cooperation and creative resolutions.

Karl Katz,
Director of The Jewish Museum

An electric night to remember

Artist David Antin (left) converses with American Motors V.P. Frank Hedge (center) and Roy Chapin

Artist Joseph Kosuth (right) exchanges information with Museum of Modern Art curator Kynaston L. McShine



Roy Chapin (left), Chairman of American Motors Corp. discusses exhibition with Curator Jack Burnham

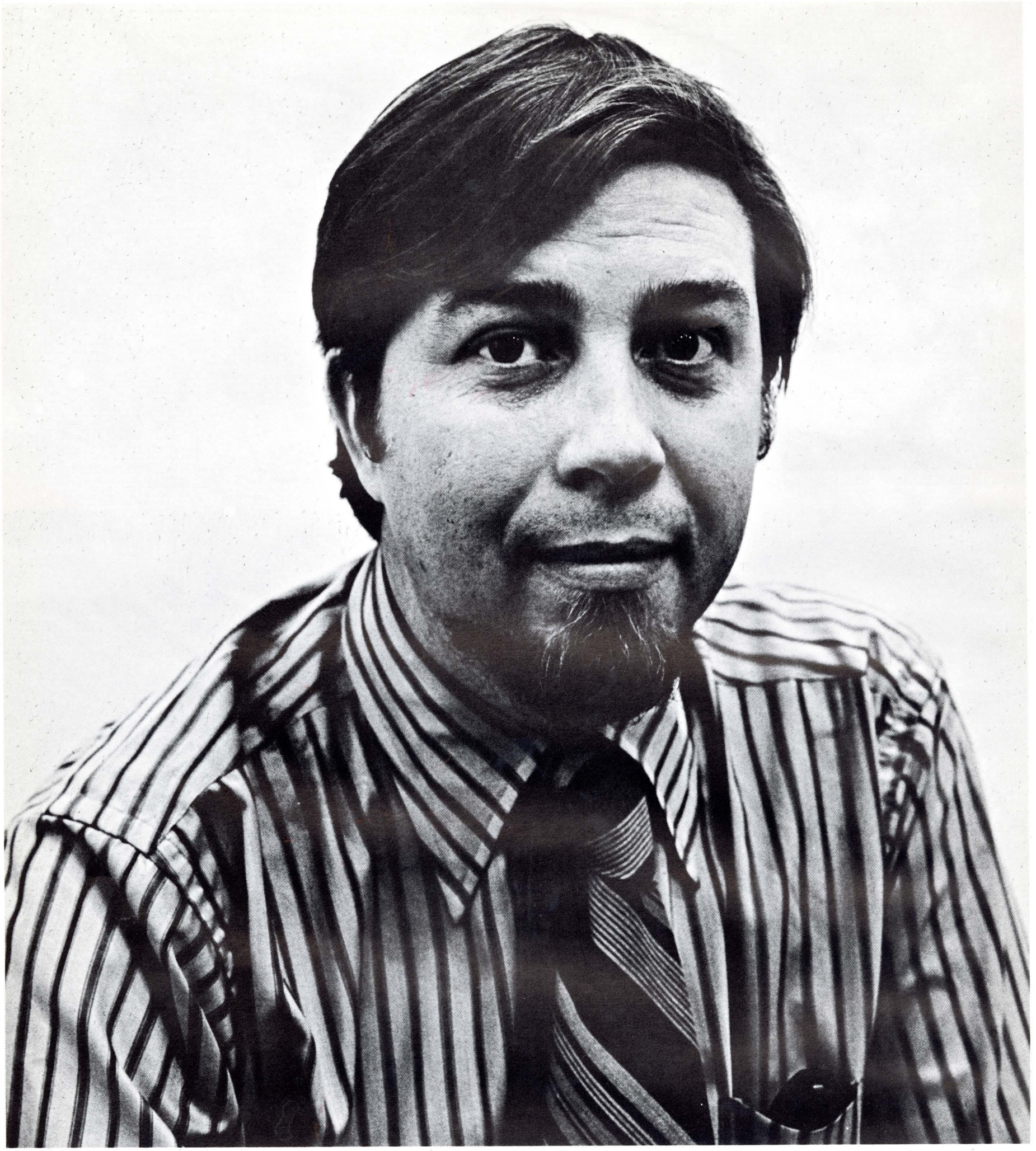
Artist Paul Conly (right), Mr. & Mrs. Roy Chapin (center), their daughter Alexandra (second from left) and Nina Kaiden Wright of Ruder & Finn

Director Karl Katz (left) watches museum visitors interact with Interactive Paper Systems

Opening night visitors like to congregate near the stairs

Caroline S. Lerner of Ruder & Finn with Peter Brown (left) and Ben Johnson of American Motors' exhibit staff

Spectators seek out the popular gerbils



Notes on art and information processing

Jack Burnham

Software is not specifically a demonstration of engineering know-how, nor for that matter an art exhibition. Rather in a limited sense it demonstrates the effects of contemporary control and communication techniques in the hands of artists. Most importantly it provides the means by which the public can personally respond to programmatic situations structured by artists. *Software* makes no distinctions between art and non-art; the need to make such decisions is left to each visitor. Hence the goal of *Software* is to focus our sensibilities on the fastest growing area in this culture: information processing systems and their devices.

In just the past few years, the movement away from art objects has been precipitated by concerns with natural and man-made systems, processes, ecological relationships, and the philosophical-linguistic involvement of Conceptual Art. All of these interests deal with art which is transactional;

they deal with underlying structures of communication or energy exchange instead of abstract appearances. For this reason most of *Software* is *aniconic;* its images are usually secondary or instructional while its information often takes the form of printed materials. In such forms information processing technology influences our notions about creativity, perception, and the limits of art. Thus it may not be, and probably is not, the province of computers and other telecommunication devices to produce art as we know it; but they will, in fact, be instrumental in redefining the entire area of esthetic awareness.

"The concept of cybernetics now represents a kind of historical snapshot, the germ of an insight expanded and modified far beyond its origins."

Planning for the *Software* exhibition began early in 1969 when Karl Katz assembled representatives from the art and the computer fields to review the feasibility of such an undertaking. The theme at that time was vaguely "cybernetic" or a sequel to the Museum of Modern Art's "The Machine as Seen at the End of the Mechanical Age" (1968). More than anything, those early discussions were memorable for communication obstacles between laymen and experts in their respective fields. Somehow the term *cybernetic* meant little or nothing to the art representatives present—except that it epitomized a very complicated and important field—while it stood for an idea already a little too general and passé to computer specialists.

A touchstone which we all shared in those first months was *Cybernetic Serendipity: The Computer and the Arts,* a book-catalogue compiled and edited by Jasia Reichardt for her exhibition at the London Institute of Contemporary Art in 1968. In a most complete way, her exhibition attempted to document how computer and various cybernetic devices have been used creatively, both within and beyond the arts. *Cybernetic Serendipity* contained much basic information on the historical development of digital computers. It included scientific experiments and works by artists which utilized the principle of feedback in machines designed to respond to external and/or internal stimuli. Other exhibits featured printouts (visual diagrams) from computers as used in music analysis and music synthesis, computer graphics and movies, computer-designed choreography, and computer poems and text analysis. Since *Cybernetic Serendipity* was in many ways a very comprehensive exhibition in the form of an historical resumé, we felt that *Software* should not cover the same ground. Moreover, we wanted to use computers in a museum environment, a sizable technical feat which the earlier exhibition did not attempt.

In the spring of last year we set about redefining the scope of the present exhibition as "The Second Age of Machines". In regard to this, one of the landmarks in the history of science occurred in 1947 when the M.I.T. mathematician Norbert Wiener along with his colleague Arture Rosenblueth of Harvard, coined the word *Cybernetics.* At a basic level, Cybernetics refers to "the set of problems centered about communication, control, and statistical mechanics, whether in the machine or in living tissue."[1] Wiener's subsequent research, along with that of many other scientists, led to a working concept that the behavior of all organisms, machines, and other physical systems is controlled by their communication structures both within themselves and with their environments. Research and development in the last twenty years has led to so many new ideas that the concept of cybernetics now represents a kind of historical snapshot, the germ of an insight expanded and modified far beyond its origins. In a sense, the original purpose of Cybernetics was to produce a unified theory of the control levels and types of messages used by men and machines and processes in normal operation. Thus the history of computer technology may be interpreted as progress in making communication between men and machines more natural and complete. This remains an ideal definition however, because quite often in industry human beings have been adapted to inhuman machine schedules, rather than the other way around. What is less realized is that most businesses of any size have had to adapt themselves, more or less traumatically, to radically different patterns of administration and organization as the result of information structures made possible by computer systems. So in part *Software* addresses itself to the personal and social sensibilities altered by this revolution. By and large these alterations have been internal, in the form of new procedures and ways of dealing with physical reality, rather than purely visual responses. With this in mind, Les Levine suggested the name for the present exhibition.

Throughout the history of computer technology 'software' has always meant changeable programs and procedures. Its genesis could be related to an idea held by the mathematician and computer scientist Marvin Minsky. He compares our intellectual conception of machines to the duality of the mind-body question which philosophers have pondered and debated for hundreds of years. All solutions to the problem, either idealistic or materialistic, contradict evidence which the body presents of its own functioning. But for practical purposes we have contented ourselves with the dualism that the body functions as one form of activity and the mind as another. Minsky states that "One area concerns *mechanical, geometrical,* and *physical* matters; the other deals with things like *goals, meanings,* and *social interactions.* When we see an object we account for its mechanical support in the first domain—we ask who put it there and why in the second."[2]

"Our bodies are hardware, our behavior software"

Minsky concludes that we build machines in our own self-image—although such a separation between body and mind may be no more than an illusion fostered by our lack of scientific knowledge about human biology and communication systems in general. While the integrationist tendencies of systems design tend to play down such differences, in a very real way the division between *software* and *hardware* is one that tangibly relates to our own anthropomorphism. So in a sense this exhibition represents 'the state of art' as it is presently conceived. Yet it must be remembered that software originally referred to those aspects of a computer system most easily changed. This is no longer true since hardware sometimes can be replaced more quickly and cheaply than software. Here again distinctions begin to blur.

For computers, hardware components include processors, memories, display devices, communication equipment and other tangible computer subsystems. Software, or stored programs, has equal value, and perhaps with future refinement of computer systems it will be considered more important than hardware. The concept of

software includes general and special purpose computer languages, programs such as instructional procedures, dictionaries, and so forth. In addition to stored information, software has come to mean for some engineers the process of systems-design itself; thus systems procedures, from flow diagramming to putting computer systems in working order, all fall under the heading of software. Thinking in systems terms, hardware and software interact, determining each other's structure for a given problem. Consequently the tendency is to think of both in unified terms.

Supplementing the above description, Theodor H. Nelson, technical adviser for *Software,* provides these examples of software:

"*Plans and procedures for action,* as distinct from the equipment that carries the action out. Thus in a transportation system the hardware consists of cars, highways, traffic lights and policemen, while the software consists of rules, such as drive on the right, stop on a red light, etc. Another example: subway cars and tracks are hardware, routes A, E, and BB are software. Finally: our bodies are hardware, our behavior software.

Software is the part of a system which is more easily changeable. In computer design we recognize no absolute distinction between machines and programs; often we have a choice of wiring a certain mode of behavior into equipment, which is faster but more expensive, or leaving the behavior to be done by a program, which is more flexible and cheaper. This choice, a matter of economics and engineering preference, is called the "hardware-software tradeoff", a renowned problem. The situation is now made more complicated by introduction of the term *firmware,* additional changeable programs which effectively rewire the hardware.

Software has a third meaning of sorts. In publishing, the terms "hardware" and "software" have for some reason been adopted as meaning *objects* (such as physical books) and *content* (what's printed in them). This is unfortunate, since in computer-based text systems we must distinguish between the hardware (computer and reading screen), software (computer and display *program*) and content (what is read)."

"Machines carry on brilliant dialogues with articulate human beings and very uninspired conversations with dull people"

The term software has also been adopted by the commercial and advertising world to mean any kind of stimulus or environmental conditioning, possibly including the shaping of public opinion. This could also be construed as information taken from the environment by a system, living or inorganic. We might even expand the notion of software to include any kind of data, but already this annihilates the traditional distinction between software (procedures) and data (information operated upon). Nevertheless, the exhibition contains all of these overtones and probably a few not mentioned.

Used in the art format, any notion of software leads one to reconsider our historical notions of art. Normally the context of art is a painting, sculpture, or perhaps a gallery environment. Contexts lend meaning to art works or art ideas: they "frame" the work, so to speak. All works of art function as *signs*; that is they signify in some form or other how they are operative within the art context. Moreover, it is becoming evident that the material presences of frames or even gallery spaces are no longer necessary for placing signs in the art context. For sophisticated viewers, contexts are implicitly carried over from previous art experiences. Thus many of the exhibits in *Software* deal with conceptual and process relationships which on the surface seem to be totally devoid of the usual art trappings.

One of the purposes of *Software* is to undermine normal perceptual expectations and habits which viewers bring to an art exhibition. In some cases this is done by deliberately separating or isolating communication structures from their usual surroundings. In daily life we receive thousands of "messages", most of them unconscious, upon which we act. The same is true of behavior in an art gallery. Artists' messages are frequently ignored by a non-participant or someone without the needed training to respond to certain cues. In this sense the idea of *Software* detracts from the notion of art as a system of tangible expectations and predigested signs. Rather *Software* is about experiencing without the mental cues of art history. Instead it is saying: "sense your responses when you perceive in a new way or interact with something or someone in an unusual situation". For this reason *Software* regards the perceived appearance of the art object as a fraction of the entire communication structure surrounding any art. Introspection rather than inspection is the point of the show.

The machines in *Software* should not be regarded as art objects; instead they are merely transducers, that is, means of relaying information which may or may not have relevance to art. Visitors to *Software* should have the opportunity to interact in varying degrees with the systems at hand. In all cases such "interaction" falls short of the level of richness found in ordinary human conversation. Yet another goal of *Software* is to make it clear that art itself is a form of intermittent dialogue. We are trying to make that sense of dialogue a conscious event.

A few years ago one of the inventors of the first conversational computer programs, Joseph Weizenbaum of M.I.T., observed that machines carry on brilliant dialogues with articulate human beings and very uninspired conversations, using the same program, with dull people. Any "art" that transpires—if such a term is needed—is the direct result of interaction between the computer's software and the "program" (behavioral idiosyncrasies) of a human being. In a similar sense, the printed materials which convey many of the conceptual works in the exhibition are not art in themselves; rather their concepts and processes, as perceived, recapitulate art experiences. Such a view of reality insists that nothing *has* art as an innate quality, but that the art context of an object or environment is always provisional and always open to challenge.

Such philosophy of insubstantiality appears to be a form of scientific Neo-Platonism—that is, knowledge free of the effects of direct sensory affirmation. The objective of *Software,* however, is to stress the fact that information is simply a *measure of response* between sender and receiver; the ability to change someone's mind about something is the measure of data's worth as information. (Note: In the computer field information is a commodity, something which has monetary value for a client. In the usual mathematical context of information theory, information is seen as a process between entities, one with no objective value for anyone.) All information becomes obsolete unless it remains in a meaningful context to us. The objective of art history and most retrospective disciplines is to counteract the natural effects of time on information by turning the past into a form of information

which remains relevent in the future. If this seems exaggerated, consider the fate of many objects once removed from their elevated contexts in tourist guides and art histories. History is a conservative but necessary force which preserves by providing a mythical ambiance for objects and buildings that formerly would have been discarded.

In a very real sense the structure of a computerized society comes in direct conflict with the *Art Ideal.* As Warren Brody and Nilo Lindgren have written, using computers in a society dominated by traditional knowledge structures is an invitation to chaos. The writers observe that information is always defined by a point of view, whether a favored theory, an available technology, or a social condition. But in a world rapidly being forced to separate information from habitual procedures, "It is not even possible to gauge how deeply our classical concepts are rooted, until *after* we have adopted the evolutionary viewpoint that regards information as continuously being evolved from the unknown, metabolized into meaning, and finally reconstructed into noise . . . Man survives as a creature who continually changes and evolves, a creature who feeds on novelty, who reorganizes himself as he reorganizes his physical world and maintains stability by this process of change."[3] It might be observed that presently in the United States a group of museums are creating the most elaborate index of known art works ever assembled—all to be filed in computer programs for the future use of all museums and scholars. It almost seems as though we are exchanging myths while retaining the original mythic structure, i.e., art history transformed into a kind of comprehensive electronic memory, one given to the same modes of mythic organization that pervaded tribal life in the past.

"No group of artists involved with computers and electronics is going to win compliments for their humanistic endeavors"

As a popular interpreter of technology Marshall McLuhan has commented on the same evolutionary values. In *The Gutenberg Galaxy* McLuhan defines machines of the nineteenth century, the effects of mass production, and the technology of the printed book as "homogeneous segmentation", or the proliferation of experience through duplication. This, according to McLuhan, is "the method of the fixed or specialist point of view that insists on repetition as the criterion of truth and practicality."[4] For example, it is safe to say that the popularity and efficacy of modern art is to a large degree the result of good, cheap color reproductions produced by the millions. The magic of personal creativity in the Machine Age was, and to some degree still is, the recreation of the individual's gesture through the anonymous, all-pervasive means of the mass media. So, increasingly the importance of the work of art is seemingly in direct proportion to the number of times it is reproduced for popular consumption. Literacy, in McLuhan's judgment, produces a closed circuit of values, one that makes the distinction between art and non-art not only possible but necessary. In mythic terms, works of art are singular or unique; but paradoxically we reinforce this uniqueness through mass production of the art object's image. The non-literate tradition produced myths and tales which could be told over and over again in an infinite number of ways; with the coming of the book, their counterpart was the idea of the masterpiece. But again our concept of perpetuating important information may be changing; in McLuhan's words: "Today our science and method strive not towards a point of view but to discover how not to have a point of view, the method not of closure and perspective but of an open 'field' and the suspended judgment. Such is now the only viable method under electric conditions of simultaneous information movement and total human interdepedence."[5]

Software is McLuhan's idea of the present environment which cannot be art because it is not yet behind us and conceptually codified. For many visitors there will be no "art" in the motion pictures, conceptual displays, television monitors, computer-based readers, and time-sharing terminals of the exhibition—mainly because few art authorities have ever been convinced that these could contain an art experience. These activities, however, possess the sensory consistency of the oral tradition in pre-literate society. Where modifications and differences lie is still uncertain, but McLuhan has this to say about their effect upon experienced reality: "Thus the technique of suspended judgment, the great discovery of the twentieth century in art and physics alike, is a recoil and transformation of the impersonal assembly-line of nineteenth century art and science. And to speak of the stream of consciousness as unlike the rational world is merely to insist upon visual sequence as the rational norm, handing art over to the unconscious quite gratuitously. For what is meant by the irrational and the nonlogical in much modern discussion is merely the rediscovery of the ordinary transactions between self and the world, or between subject and object. Such transactions had seemed to end with the effects of phonetic literacy in the Greek world."[6]

Yet the ultimate achievement of McLuhan's visions is still very distant. In many instances so far the information processing technologies have only aggravated the suppressed anxieties of Machine Age politics and economics. As demonstrated in Nelson's essay on "cybercrud", we seem to be the victims of a perpetual consumer's fraud, no matter how promising the hardware and software. In terms of the art world, no group of artists involved with computers and electronics is going to win compliments for their humanistic endeavors. Yet at some point an attempt has to be made to put the issues of all contemporary communication, not just esthetic communication into a questioning frame of reference. Already we have witnessed a revolution in usage. Twenty years ago computers belonged to a tiny, highly skilled, mathematical elite—a priesthood; ten years later laymen who bothered to master cumbersome computer languages could use them; and today, as evidenced by this exhibition, people with no special training have access to computers. Thus in practice there has been a steady trend towards democratization.

"It appears we cannot survive without technologies just as dangerous as the dilemmas they are designed to solve"

Yet this is a different age in which we are beginning to read *esthetics* into budgets, planning procedures, and priorities—and not so much into finished products. When means become ends we ask such questions as how do electronic information processing systems affect the psychological outlook of the average human being? Furthermore, the possible goals and uses of super-human intelligent computer programs—if and when they become a

reality—are still very unclear even at the highest levels. Automation or semi-automation of work tasks does not insure that they are any less boring than before since much depends upon the job and planning that goes into them. Computer programming can be the most varied and creative activity that one can do on salary, allowing the most initiative and variety of personal means of expression. However, in some business situations a certain kind of low-level programming (also called "coding") is employed; much worse, keypunching is certainly intolerable. Thus personal contact with such machines ranges from the most rewarding to the most boring and regimented experiences possible. On another level, computerized data files on individuals continue to be an extremely serious threat to human rights, and one against which there are few real protections. In a survey on the effects of computer data banks, Jerry Rosenberg[7] finds it significant that the most negative attitudes are shared by people whose work exposes them to computerized data-gathering.

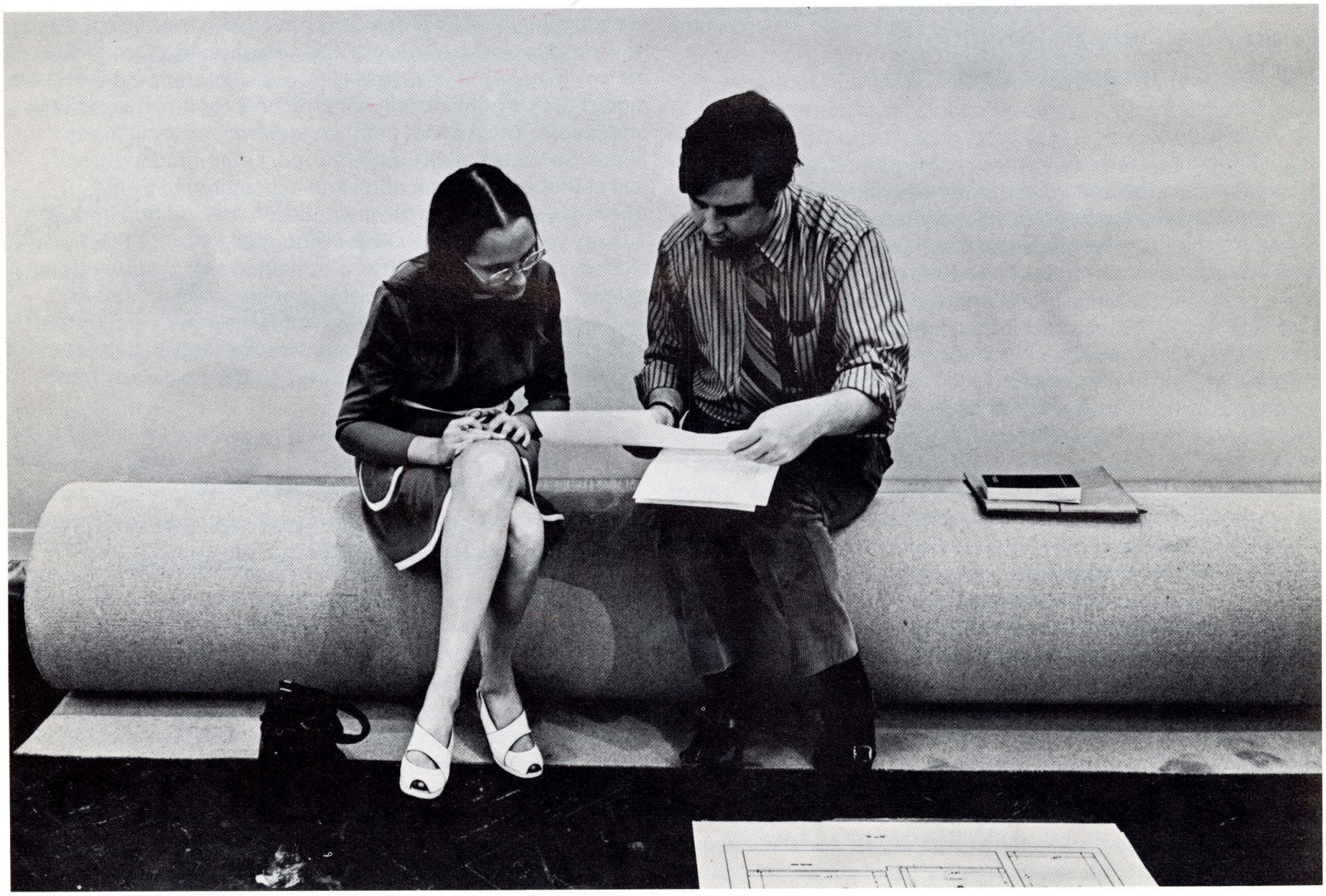
As our information storage problems expand in magnitude (along with our statistics needs and resource management problems in ecology) we are forced to confront the computer as one of the few practical solutions. This produces a very real paradox: it appears that we cannot survive without technologies potentially just as dangerous as the dilemmas they are designed to solve. We might ask ourselves if future generations of information systems will be used with any more sensitivity than radio and television have been up to now. Apparently once esthetics is removed from the tidy confines of the Art World, it becomes infused with ethical, political, and biological implications that are overwhelming but nevertheless critical.

Many of the finest works in the *Software* exhibition are in no way connected with machines. In a sense they represent the "programs" of artists who have chosen not to make paintings or sculptures, but to express ideas or art propositions. After experiencing examples of Conceptual Art, it becomes apparent that machines can only handle the ideas given to them by human beings. What machines do is to telescope and edit experiences in a way that printed materials cannot.

Again *Software* is not technological art; rather it points to the information technologies as a pervasive environment badly in need of the sensitivity traditionally associated with art. Since people will continue to make poems and paintings without computers, *Software* focuses on modes of creativity and creative assistance which are more or less unique to the electronic age. Remembering the Latin derivation of *art,* the term *ars* in the Middle Ages was less theoretical than *scientia:* it dealt with the manual skills related to a craft or technique. But present distinctions between the fine, applied, and scientific arts have grown out of all proportion to the original schism precipitated by the Industrial Revolution. Thus *Software* makes none of the usual qualitative distinctions between the artistic and technical subcultures. At a time when esthetic insight must become a part of technological decision-making, does such a division still make sense?

June 1970

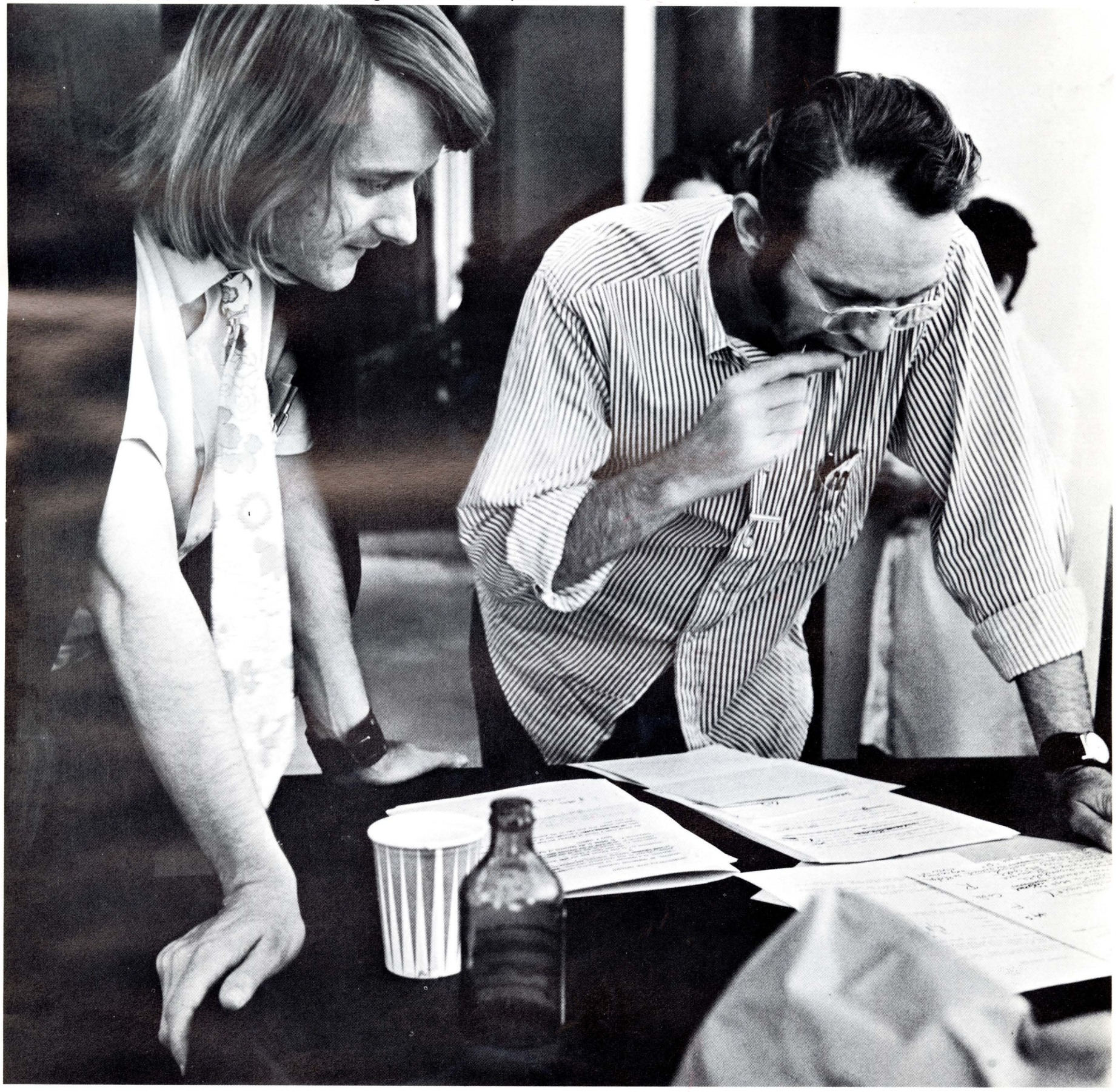
1. Wiener, Norbert (1948) *Cybernetics: Or Control and Communication in the Animal and the Machine* (The M.I.T. Press: Cambridge, Massachusetts, 2nd edition, 1961) p. 11
2. Minsky, Marvin (April 1969) "I think, Therefore I am" in *Psychology Today* p. 31
3. Brody, Warren and Lindgren, Nilo (September 1967) "Human Enhancement Through Evolutionary Technology" in *IEEE Spectrum* p. 91
4. McLuhan, Marshall (1962) *The Gutenberg Galaxy* (Signet Books: New York, 1st edition, 1969) p. 327
5. *Ibid.*
6. McLuhan, p. 329
7. Rosenberg, Jerry M. (1969) *The Death of Privacy* (Random House: New York) p. 139



Curator Jack Burnham consults with Exhibition Coordinator Joanne Lupton

An installation design that minimizes 'museum atmosphere'

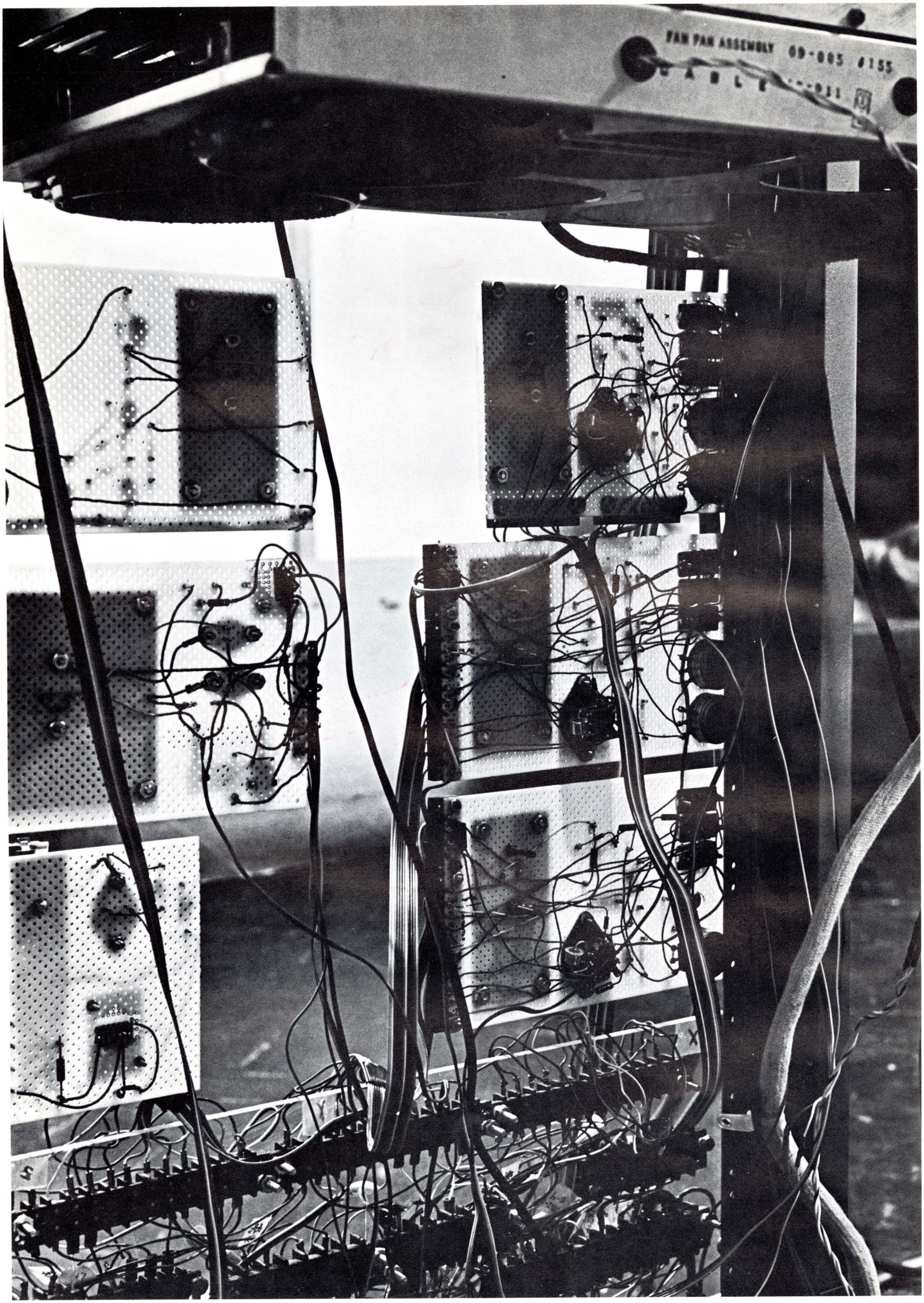
James A. Mahoney (right) and Theodor H. Nelson go over exhibition plans.



I did not anticipate the difficulty of the installation when a group of us attended a meeting at which the concept for the exhibit was established. The first realization of a unique exhibition design and installation problems came months later with the realization that the work of many artists produces no objects. Equipment there is—but no "objects of art".

Inside the museum, the visitor will find lightness and darkness, two constant elements of day-to-day existence. This is both a lighting and color consideration. Light and dark shades of gray (for concrete or metal) were discarded. Software is not restricted to the city, nor to machines. Noise levels from machinery, it was decided, would be dealt with at installation—we live with noise and we have learned that we tolerate it within certain bounds. Visitors to the exhibition will have to concentrate because we are not isolating individual works of art to be appreciated. Hopefully nothing is hidden and nothing is obvious.

James A. Mahoney, Exhibition Designer


FAN PAN ASSEMBLY 69-005 #155

The crafting of media

Theodor H. Nelson

The strange revolution of our information environment has only begun; yet it has begun in such an obscured and clouded form that the public sees only various meaningless disguises.

The all-purpose machine, as von Neumann called it, has been falsely promulgated to the public as the socalled *computer,* numerical, uncompromising, demanding and intractable. It has profited certain computer companies to make "computers" and their associated techniques incomprehensible and awesome; these same companies now seem unprepared for the widespread public revulsion to this image of the computer. It has profited some computer companies to build ungainly and obscure systems for business purposes, badly related to what their business customers do; and to con the customer and his poor employees into believing it has to be that way; this keeps the hapless customer on the hook indefinitely. These same companies now seem unprepared to have their all-wisdom questioned.

I would like to employ the word *cybercrud* to mean, in general, putting things over on people using computers. Cybercrud is one of the most important specialties, if not the economic backbone, of the computer field. The promotion of false or clumsy approaches to a problem as "scientific," the frequent claim that "the computer has to have it that way" —when a certain thing could be programmed very differently —are cybercrud.

But the computer is an all-pupose machine, and the computer display—a screen programmed to present text and pictures somehow stored in the computer—is a universal miraculous communication tool, as Ivan Sutherland showed in the early sixties with his Sketchpad system. And computer prices, unlike other prices, go down relentlessly. Expensive as these devices may be today, within the decade small good ones will cost a few hundred, at most a few thousand dollars. As we learn to free ourselves from cybercrud, the question becomes not, "how do I relate to this sinister, demanding artifact?" but "what is the grooviest way to use this thing?" The human environment can now be wholly, wonderfully redesigned. What do we want? What do we want?? What do we want???

Until now, our media—letters, books, television—have been based on specific inventions and technical connections. But no longer are specific inventions of special importance: information may be commuted to any form, functioning networks may be built connecting any device to any other device; total trans-pluggability has come. (Imagine if you will a device with a red oval 2-inch TV screen, a set of chimes in the natural key of C, a smell generator capable of giving off most smells, and a foghorn. Should the F.C.C. authorize this combination as a broadcast medium?)

The design of media is thus in a sense a new art; before, we could tinker little with the package. I suggest the term "fantics" for the art and technology (in that order) of showing things; the crafting of media for human communication purposes is therefore its most important franchise, something like "city planning" in generality. Making things look good, feel right, and come across clearly should be a general objective.

We should distinguish between media and facilities. A facility is an available activity, or function, like a movie splicer or desk calculator. A medium is a set of presentation elements, and relations among them, that may be used by a person to create an object, environment or experience for someone else.

Creating media that are *organized,* then, clear and easily related to the human mind, is our task. Creating media that are focussed, or gently converging, is the delicate part. Rather than present a user with ideas and activities stretching limitlessly in all directions, a presentational system should help organize his work and attention.

This is the age of option. For instance, we may have anything we want on display screens—text or diagrams or both, moving or flickering or interacting or whatever. What do we want?

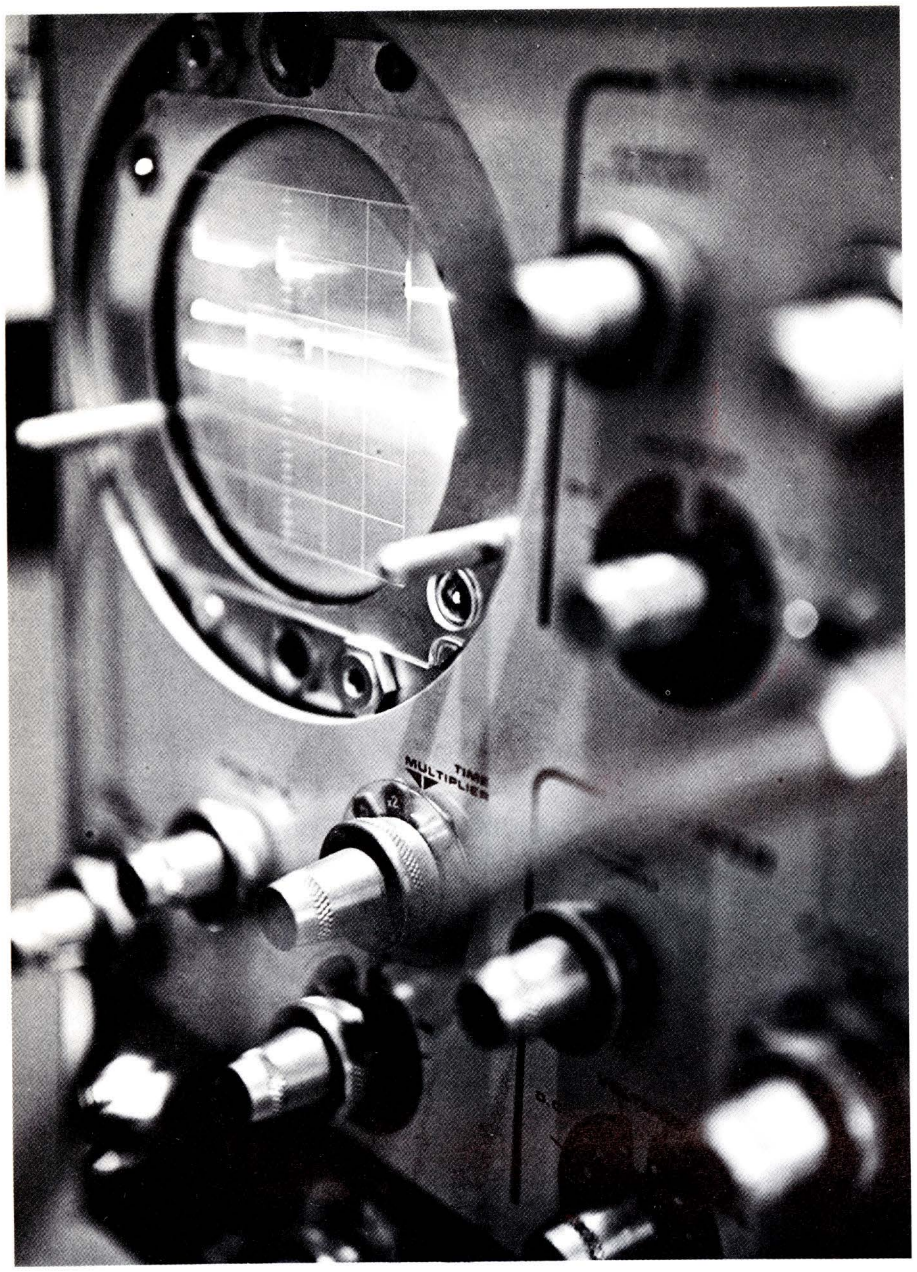
This is also the age of crunch. Ecstatic possibilities must survive various forbidding or shaping factors that might cut them down. In the design of media these include not merely economics and technicalities (such as transmission rates on phone lines), but social structure and motivation (what will the teacher put up with in the classroom? Why don't students use the language laboratory?).

Hypertexts and *hypergrams,* then, are two new species of media for the computer age: personal, dynamic, and contradictory of the heavy-handed and stupid "computer" in the general stereotype. Hypertext, or writing that can branch or perform, is seen in the *Software* show's *"Labyrinth"* piece, wherein the visitor may browse through a maze of writings on the screen. "Hypergrams," branching or performing pictures, will be the pictorial equivalent. Designing the detailed activities of the presenting systems is an important task, demanding technical knowledge, love and appreciation for words and pictures, and a sense of alternatives and inspiration.

The new age will not be "scientific." The word "scientific" is obsolete (except where specifying the activities and problems of scientists), like the adjectives "modern" and "streamlined." The technological imperative is a fake, computerization can take whatever form we wish it to; therefore we must learn about computers in order to wish better. As Burnham says at the end: "...*Software* makes none of the usual qualitative distinctions between the artistic and technical subcultures. At a time when esthetic insight must become a part of technological decision-making, would such divisions make sense?"

May 24, 1970

Bush, Vannevar, "As We May Think" in *Atlantic Monthly,* June 1945.
Sutherland, Ivan, *Sketchpad: A Man-Machine System,* Lincoln Laboratory, Lexington, Mass.
Nelson, Theodor H., "Getting It Out of Our System" in Schechter (ed.), *Critique of Information Retrieval,* Thompson Books, 1967.
Nelson, Theodor H., "No More Teachers' Dirty Looks" in *Computer Decisions,* September 1970.
Nelson, Theodor H., "As We Will Think", to be published.



Ned Woodman/Theodor H. Nelson
Labyrinth: An Interactive Catalogue 1970
with assistance from Scott Bradner (Art & Technology, Inc., Boston)
Digital Equipment Corporation (time share PDP-8 computer)

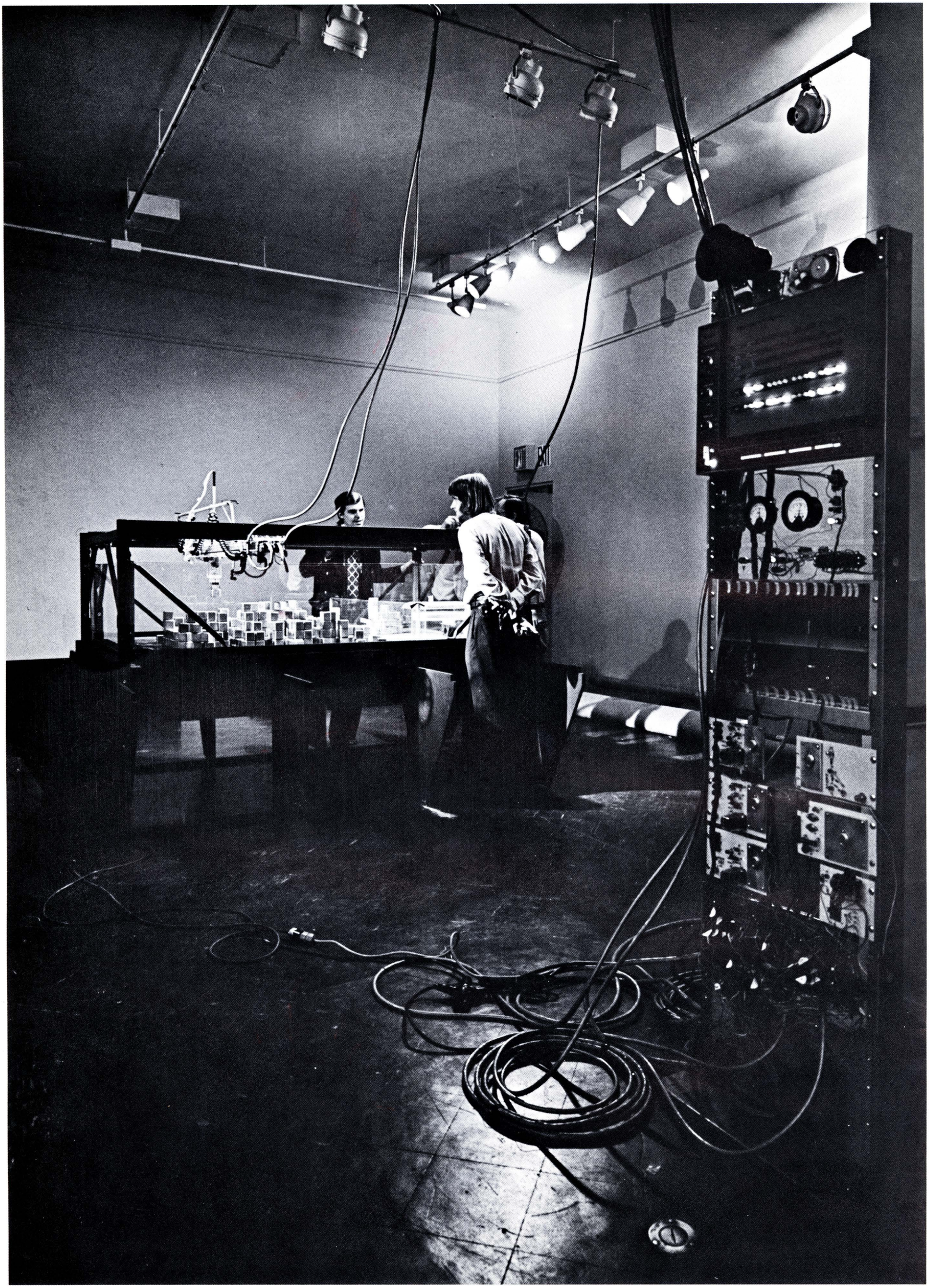
Labyrinth is a hypertext, or interactive text retrieval system. To read in this interactive catalogue, the user sits down at one of many *Labyrinth* keyscope terminals and begins to read. To read more of any section which is larger than the screen, the user types F (forward). To go back to the beginning of the catalogue, the user types R (return). To obtain a related section as indicated by an asterisk appearing in the text, the user types the code appearing with the asterisk.

Before leaving the show, the museum goer may obtain a printout of what he himself has selected to read in the interactive catalogue by giving his name to an attendant at the line printer by the main exit.

This catalogue system was programmed for the PDP-8 by Ned Woodman of Art & Technology, Inc. Interesting features of the program include the ability to output to any display scope, a temporary terminal history to allow the forward and return commands, a permanent user history permitting a final printout. The interactive catalogue for software consisting of information from the printed catalogue and additional materials has been edited by Theodor H. Nelson, who has been advocating hypertexts as a form of writing for some ten years. This is the first public demonstration of a hypertext system.

Scott Bradner (left) and Ned Woodman of ATI program their PDP-8.

LIFE IN A COMPUTERIZED ENVIRONMENT



The gerbils live in a glass-walled house with a roaming electromagnet overhead, picking up and depositing two-inch cubes.

The Architecture Machine Group, M.I.T.
Seek 1969-70

Seek is a sensing/effecting device controlled by a small general purpose computer. In contrast to an input/output peripheral, *Seek* is a mechanism that senses the physical environment, affects that environment, and in turn attempts to handle local unexpected events within the environment. *Seek* deals with toy blocks which it can stack, align and sort. At the same time, these blocks form the built environment for a small colony of gerbils which live within *Seek*'s three-dimensional world.

Unbeknownst to *Seek,* the little animals are bumping into blocks, disrupting constructions, and toppling towers. The result is a substantial mismatch between the three-dimensional reality and the computed remembrances which reside in the memory of *Seek*'s computer. *Seek*'s role is to deal with these inconsistencies. In the process, *Seek* exhibits inklings of a responsive behavior inasmuch as the actions of the gerbils are not predictable and the reactions of *Seek* purposefully correct or amplify gerbil-provoked dislocations.

Seek consists of a 5x8 foot superstructure supporting a carriage which has three dimensions of freedom. Its extremity is composed of an electromagnet, several micro-switches, and pressure-sensing devices. This elementary prosthesis is guided by the blind and handless computer to pick up or deposit its payload of a single two-inch cube. The nucleus of the system is an Interdata Model 3 Computer with 65536 single (yes/no) bits of memory which are shared by instructions and data.

Even in its triviality and simplicity, *Seek* metaphorically goes beyond the real-world situation, where machines cannot respond to the unpredictable nature of people (gerbils). Today machines are poor at handling sudden changes in context in environment. This lack of adaptability is the problem *Seek* confronts in diminutive.

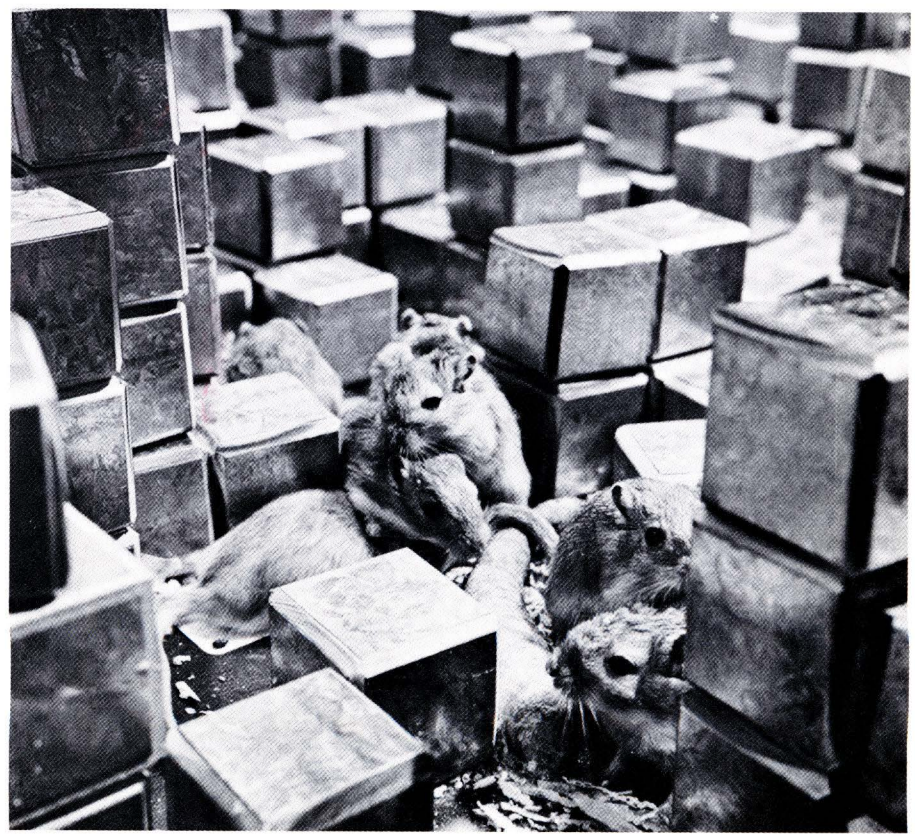
If computers are to be our friends they must understand our metaphors. If they are to be responsive to changing, unpredictable, context-dependent human needs, they will need an artificial intelligence that can cope with complex contingencies in a sophisticated manner (drawing upon these metaphors) much as *Seek* deals with elementary uncertainties in a simple-minded fashion.

Seek has been developed and constructed by M.I.T. students who form part of the Architecture Machine Group, a Ford Foundation sponsored research effort within the M.I.T. Urban Systems Laboratory. The participants have ranged from freshmen working in an Undergraduate Research Opportunities Program, to post-graduates designing elements as part of their research assistantships.

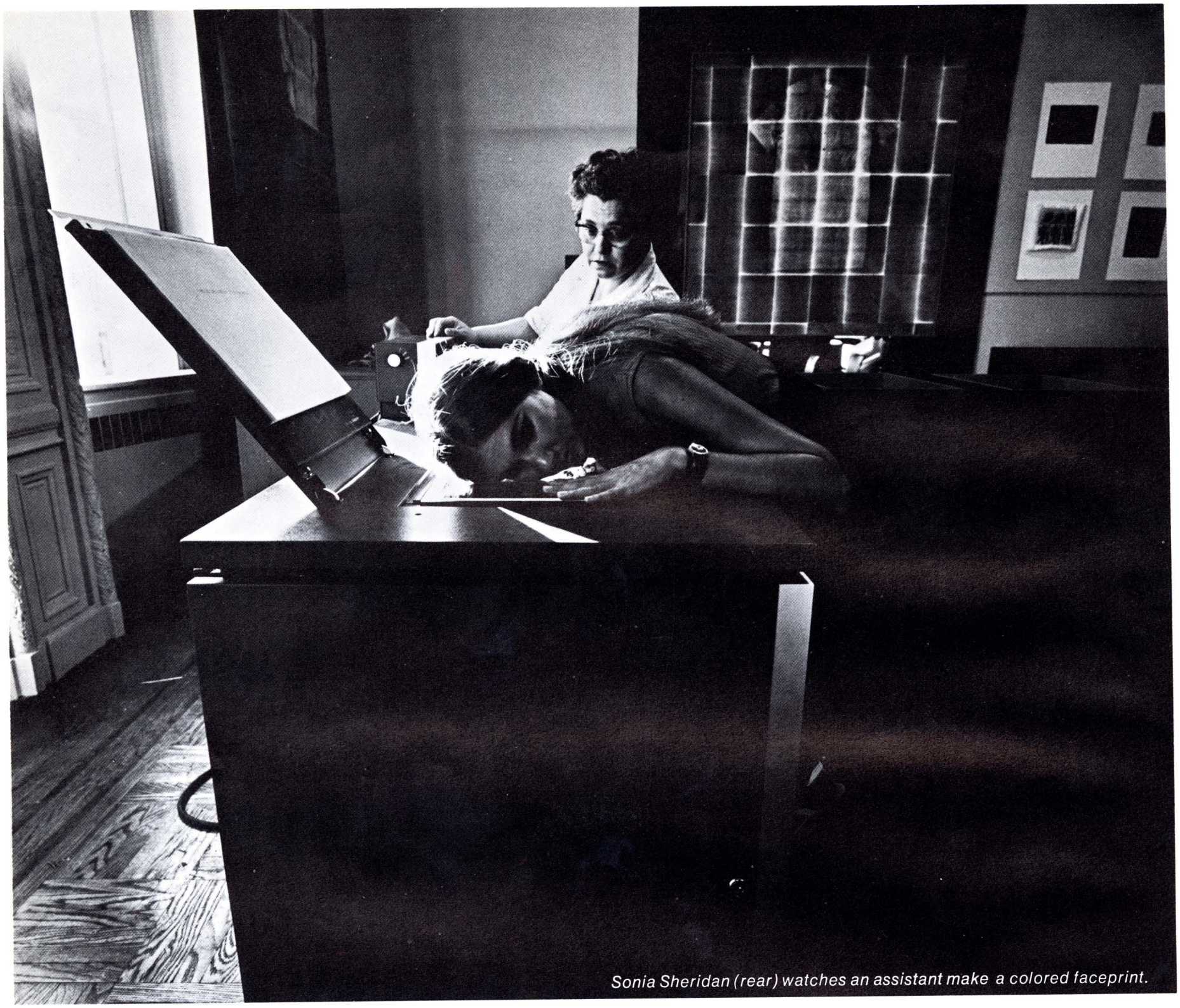
The co-directors of the group are Professors Nicholas Negroponte and Leon B. Groisser, of the faculty of Architecture and Planning. Randy Rettberg and Mike Titelbaum, students in Electrical Engineering, have been in charge of the electronics—in particular, the interface and controller. Steven Gregory, a graduate student in the School of Architecture and Planning, has been in charge of the programming. Steven Peters and Ernest Vincent have been responsible for the actual construction of the device.

Following the Software exhibition, Seek will return to M.I.T. to be used with many different detachable heads as a general purpose sensor/effector. *Seek* will become a frame for experiments conducted by students in computer-aided design and in artificial intelligence.

Nicholas Negroponte (left) with Karl Katz and Steven Gregory



Reference: Nicholas Negroponte, *The Architecture Machine,* M.I.T. Press, 1970.
Computer: courtesy The Interdata Corporation, Oceanport, New Jersey.
Gerbils: courtesy Tumblebrook Farms, Brant Lake, New York



Sonia Sheridan (rear) watches an assistant make a colored faceprint.

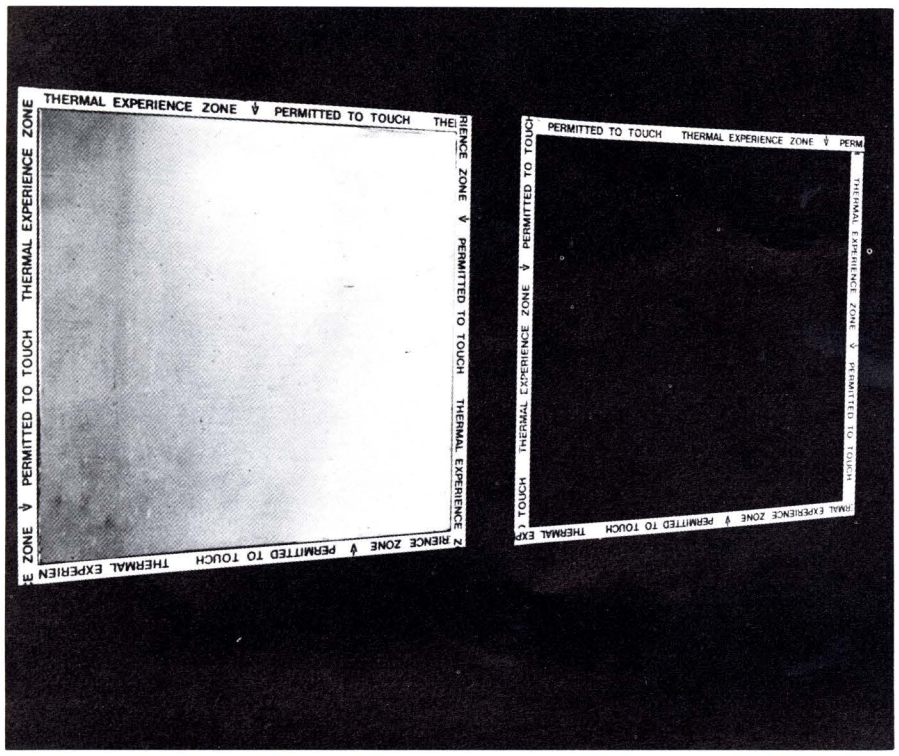
Sonia Sheridan
Interactive Paper Systems 1969-70

Part of the basic equipment for *Interactive Paper Systems,* a 3M Thermofax machine is simply a revolving belt which permits a treated paper to react to carbon as it passes in seconds through the heated machine. Demanding no special training, it can be used to produce a variety of color transparencies, spirit masters, stencils and opaque copy. Through experimentation we have discovered that some of its artistic uses lie in making large projection transparencies, copy for film making, transparencies for photo screening, freak color separations, instant textile design, image distortion and transparency collages.

The Color-in-Color machine, available for a portion of the exhibition time, is a recent 3M invention which translates into full color any two or three dimensional object which can fit in its 8″x10″ format. This instrument is a major breakthrough in the graphics field, for it can produce an endless variation of images within a span of minutes. In the hands of a creative person neither the size nor the quality of the image is limited. It can be adapted to produce images on either paper or onto a matrix, which is then transferable to any heat resistant material by means of an ordinary iron or a companion Color Processor. We have considered using this instrument for rapid film animation, instant 2-3D books, rapid textile design, light printing with stencils, colorful and dynamic correspondence and a variety of other possibilities. Michael Schumacher has done some fine photomontage work with this machine. Keith Smith exploded the size limitation by cutting up Kodalith positives and ironing them onto a huge quilt combined with silkscreen and photographs. *Cosmo,* a team of Robert Frontier and William McCabe, rephotographed the Adlai Stevenson family album on the machine, took slides and projected them so that black and white photos were completely altered. We have been able to increase the variety and volume of correspondence and to carry on interactive graphics with artists, inventors and businessmen.

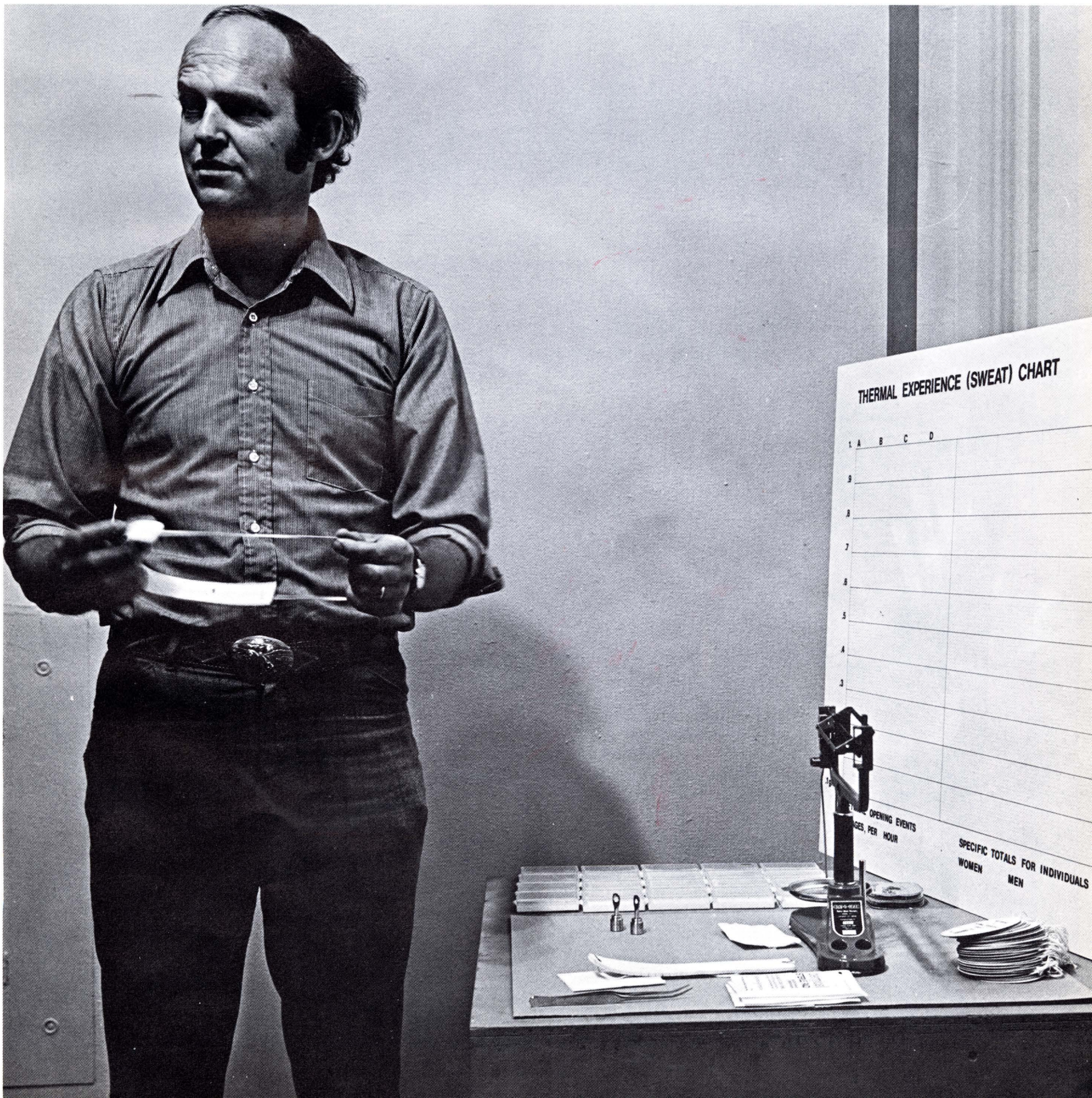
The capacity of the new graphic machines for instant production has the most profound implications for the visual world. The artist, who once spent hours rendering an orange, can photograph the orange whole, cut up into any variety of forms, or squeezed into juice, and can rephotograph it within minutes. In an hour's time he can produce 120 variations; in eight hours he can have almost 1000 different versions of the orange. It is obvious that this work process becomes another kind of time for the artist as the distance from conception to conception is reduced to minutes and objects change as rapidly as thinking allows.

Equipment on loan from the 3M Corporation



John Goodyear
Level of Heat 1970

1. Thermal Experience Zones identified by tape present the heat capacity of a variety of surfaces to the viewer's touch. Sources of heat of these surfaces include the sun, the Museum heating system (if operating) heat from the interior of the earth, heat of lighting and other electrical equipment, heat of pollutants, heat of friction, heat of the bodies of spectators.
2. Museum as Thermal Experience Zone. A test points to the entire space of the Museum as a Thermal Experience Zone, and to the body of the viewer as the sensing agent. The test will measure the perspiration of randomly chosen subjects for the duration of their visit to this exhibition. Factors involved may be the heat of the spaces, the heat of the subjects' bodies, their clothing, their physical and mental and nervous activity. Persons taking the test will be identified with a badge stating: "I am taking a thermal experience (sweat) test."



Triangulate your thoughts

Agnes Denes

Dialectic Triangulation: A Visual Philosophy 1970

Dialectic Triangulation is a simplification and systematic re-building of complexes of any subject or matter, through various methods, such as re-evaluation, re-grouping or division, at times starting with a single proposition, at others searching for the mean between two extremes. But each time it is the triangulation which institutes the interaction of a particular static state, being the activating force.

To use an example, if a person feels that within his knowledge he does not understand himself and his universe, and decides to attain greater knowledge, he has instituted a triangulation. His initiative, 'the desire to know more', being here the activating force between ignorance and wisdom.

Dialectic Triangulation is a building of progressive trichotomies, failing and succeeding in a dialectic method, each time arriving at a better thesis on a higher level—like changing scientific theories, which always advance and develop in complexity. By appraising the milestones in human knowledge and scientific achievement, we take inventory of it and of ourselves. A new curiosity and insight is born, a new awareness. And since this is an artistic probing, concrete facts are sometimes thrown into abstract corners, and abstract terms are concretized; each getting a sort of bath or soaking in the other's fluids. It is an explorative evolutionary process, the way of nature and man.

Types of triangulations:

inanimate tri-groups representing all of a genus, class or category

re-grouping or classification

accepted facts, perceptual or ideational errors re-evaluated, their importance re-established or denied—new ones created whenever possible

arriving at a conclusion derived from two propositions

arriving at a mean between two extremes

the building of one proposition through dimensional complication into trichotomies

the building of one proposition through divisional trisection into trichotomies

pure idea groups activated by controversy

interdependent or progressive ideas becoming effective through successive stages of advancement

threefold theories interchangeable—threefold theories not interchangeable, and those forming argumentative conclusions

Agnes Denes

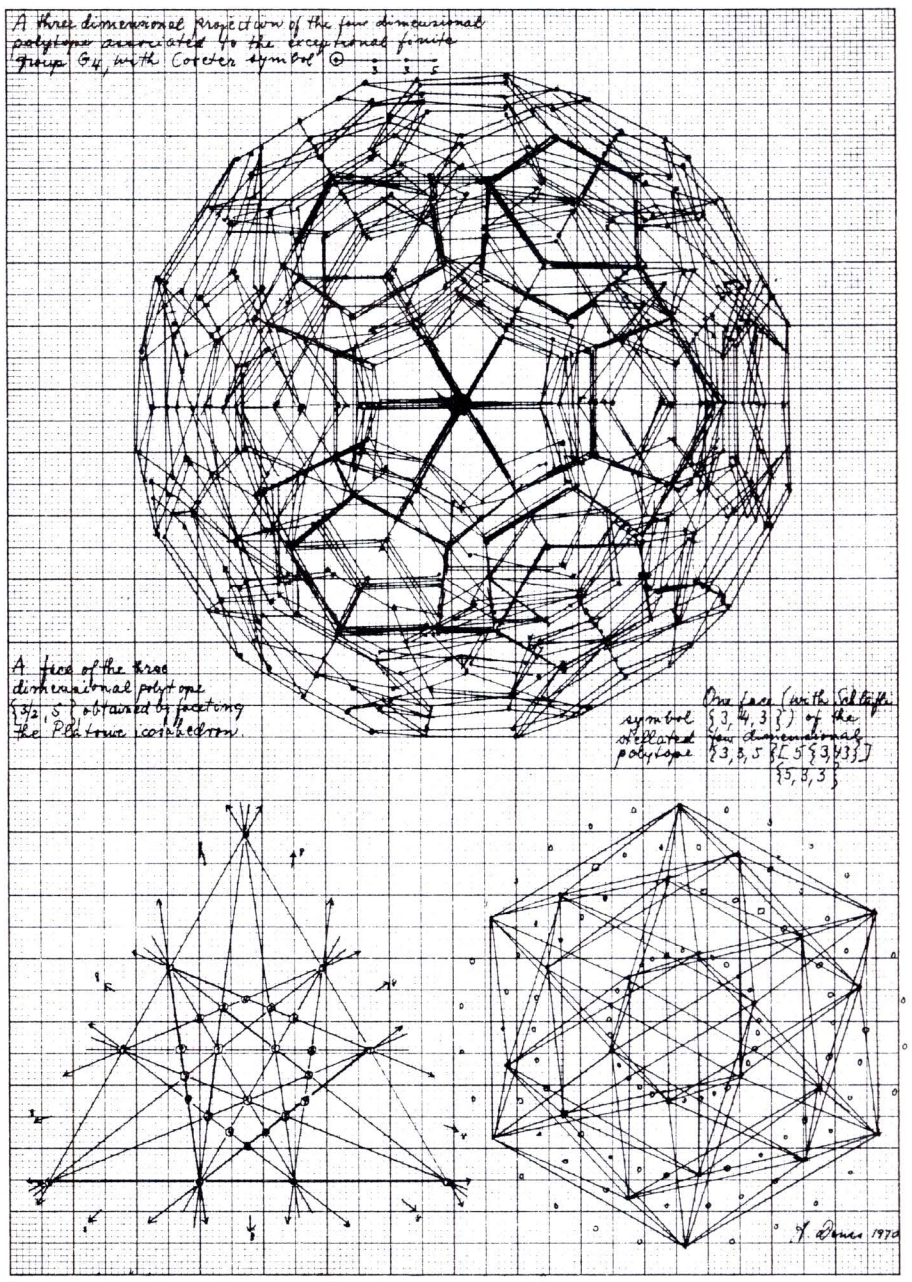
Matrix of Knowledge & Trigonal Ballet 1970

(Work for computer display) with assistance from Members of The R.E.S.I.S.T.O.R.S., Pennington, N. J.: John Levine, Nat Kuhn, Peter Eichenberger and from Theodor H. Nelson

Restoration of the triangulation concepts on the screen can be at best only partial, mentally confronting the participant with the challenge of comparing ideas and the visual consequences of a new structuring. The artist's own structural conjectures are here shared with the viewer.

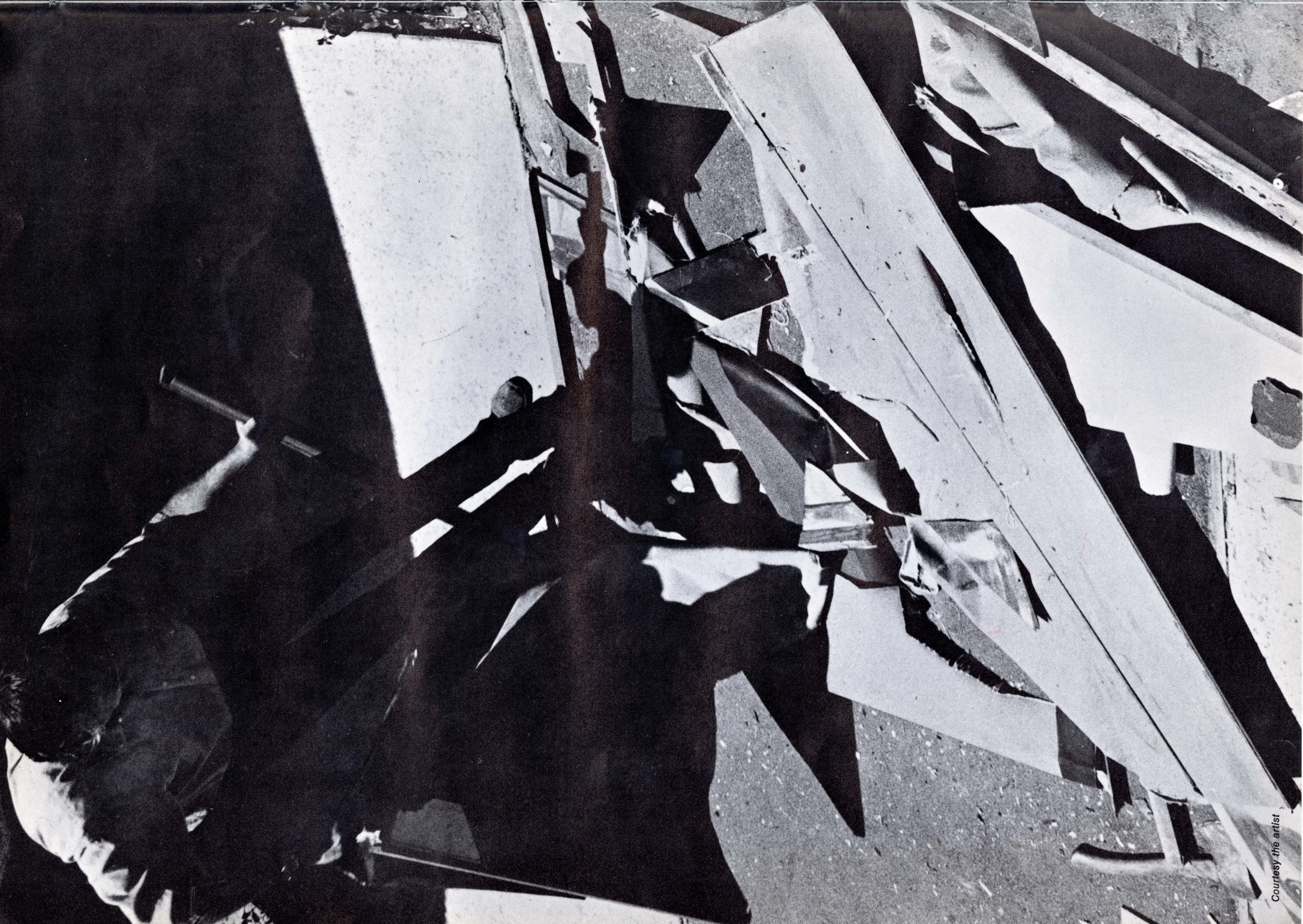
NOTE: Matrix of Knowledge schedules events in a triangular mesh. List structure is kept comparatively simple by rewriting the display file for each new incarnation of the picture.
Trigonal Ballet animates through a succession of frames to obtain its "infinite effect."

The IDIIOM, a dynamic display with its own built-in computer, is on loan from Information Displays, Inc. of Mount Kisco, New York.

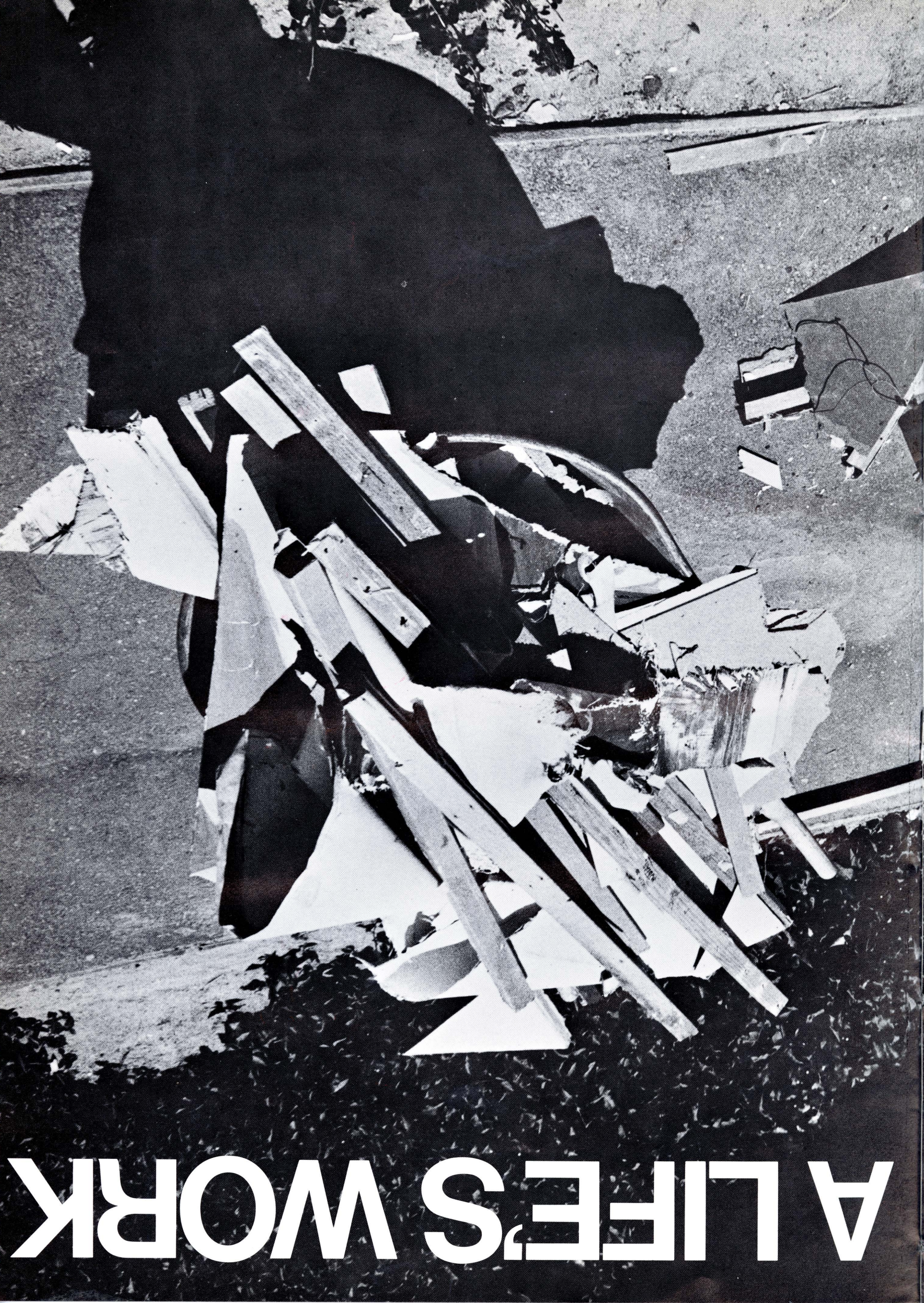

A three dimensional projection of the four dimensional polytope associated to the exceptional finite group G4, with Coxeter symbol
A face of the three dimensional polytope
One face (with Schläfli symbol
of the four dimensional polytope
Y. Denes 1970

Studies for thought-complication (completed 1970)

Agnes Denes (right) programmed her computer display with the assistance of Theodor H. Nelson and The R.E.S.I.S.T.O.R.S. (from left) Peter Eichenberger, Lauren Sarno, John Levine (not present: Nat Kuhn).



Courtesy the artist



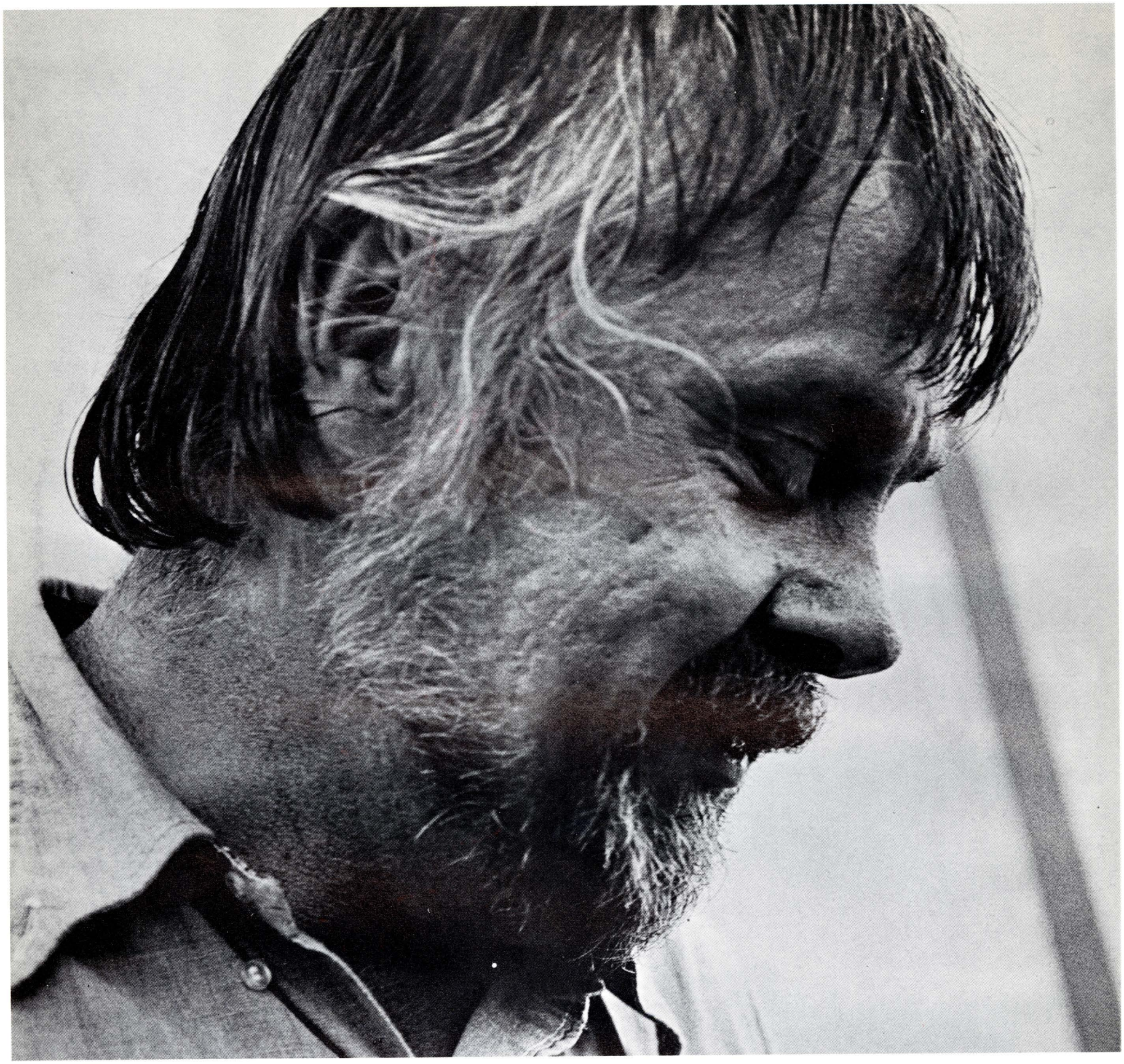
A LIFE'S WORK

...GOES UP IN

FLAMES

John Baldessari
Cremation Piece, June 1969.

"One of several proposals to rid my life of accumulated art. With this project I will have all of my accumulated paintings cremated by a mortuary. The container of ashes will be interred inside a wall of the Jewish Museum. For the length of the show, there will be a commemorative plaque on the wall behind which the ashes are located. It is a reductive, recycling piece. I consider all these paintings a body of work in the real sense of the word. Will I save my life by losing it? Will a Phoenix arise from the ashes? Will the paintings having become dust become art materials again?
I don't know, but I feel better."



JOHN ANTHONY BALDESSARI

MAY 1953 MARCH 1966

John Baldessari
Painting for Kubler, June 1969.

A lost painting: black on gray ground,
oil on acrylic, 67½″ x 56″
from George Kubler's *Shape of Time;* 1962

"This painting owes its existence to prior paintings. By liking this solution, you should not be blocked in your continued acceptance of prior inventions. To attain this position, ideas of former paintings had to be rethought in order to transcend former work. To like this painting, you will have to understand prior work. Ultimately this work will amalgamate with the existing body of knowledge."

Hans Haacke
Visitors' Profile 1969
with assistance from Scott Bradner (Art & Technology, Inc., Boston)
Digital Equipment Corporation (time share PDP-8 computer)

A teletype terminal with a picture scope is connected with a digital computer on a time-sharing basis and serves both as input and output device.

Using the keyboard the visitors can answer questions which are posed to them on the scope. Due to branches in the polling program a number of these questions are personalized and vary from visitor to visitor.

Essentially the questions are of two types. One set asks the visitors for *factual* information about themselves, e.g., age, sex, educational background, income bracket, etc. The other set of questions inquires about their *opinions* on a variety of subjects.

The computer compiles the answers, compares them with information received from other visitors and correlates data relevant for a statistical breakdown.

A terminal prints out the processed information in the form of statistics giving percentages and cross-tabulations between answers, opinions and the visitors' demographic background. The processing speed of the computer makes it possible that at any given time the statistical evaluation of all answers is up to date and available. The constantly changing data is projected onto a large screen, so that it is accessible to a great number of people.

Based on their own information a statistical profile of the exhibition's visitors emerges.

Hans Haacke
News 1969

Local, national and international news is being received from U.S. as well as from foreign news services. It arrives in the exhibition via teletype print-out at the same time as it is being received by the other clients of the various news services. The print-out accumulates and piles up behind the teletype machines.

Visitors peruse News

You're the art!

Douglas Huebler
Variable Piece No. 4
New York City, May 1969

Anyone who wishes to participate in the transposition of "information" from one location to another may do so by following the procedure described below. By doing so each participant will exchange an original secret normally located only within his, or her, head, for a photocopy of a secret submitted by another person at a prior time.

1. Write out, in simple language, an *authentic* secret never before revealed by you.
2. Slip this paper (unfolded) into the slot of the box provided for the receipt of "incoming" information. Your secret will be photocopied and, in turn, become the exchange information made available on a subsequent occasion.
3. The operator of the photocopy machine will acknowledge your submission by giving you the photocopy of another's secret. (If you choose, you may submit as many as five secrets and receive an equal number in return.)

Douglas Huebler
Variable Piece No. 5
Halifax, Nova Scotia, October 15, 1969

Ten students at the Nova Scotia College of Art and Design collaborated in the process that formed this piece. They did so by fabricating a myth and launching it into an original and true existence through ordinary information systems... word of mouth, publication, etc.

This process began in the Fall of 1969 and, although the myth possesses the capacity to expand to infinite points in time and space, for the purposes of this piece its destiny was set to be terminated on April 1, 1970 at which time all documents relating to its existence during the period described and this statement join altogether to constitute the form of the piece.

Douglas Huebler
Location Piece No. 13
Washington, D. C.; Haverhill, Massachusetts, November, 1969

On November 13, 1969, Joseph Moran, Managing Editor of the *Haverhill Gazette* agreed to have this artist serve as special correspondent and photographer for that newspaper and, in that capacity, to return a news story covering the experience of the so-called "Haverhill contingent" during the period of time that it travelled to and from Washington, D.C., and especially of its participation in the Peace March on November 15, 1969.

That report (as printed in the *Gazette* on November 17, 1969) joins with this statement, and three photographic contact sheets to constitute the final form of this piece.

Douglas Huebler
Variable Piece No. 15
Salem, New Hampshire, March, 1970

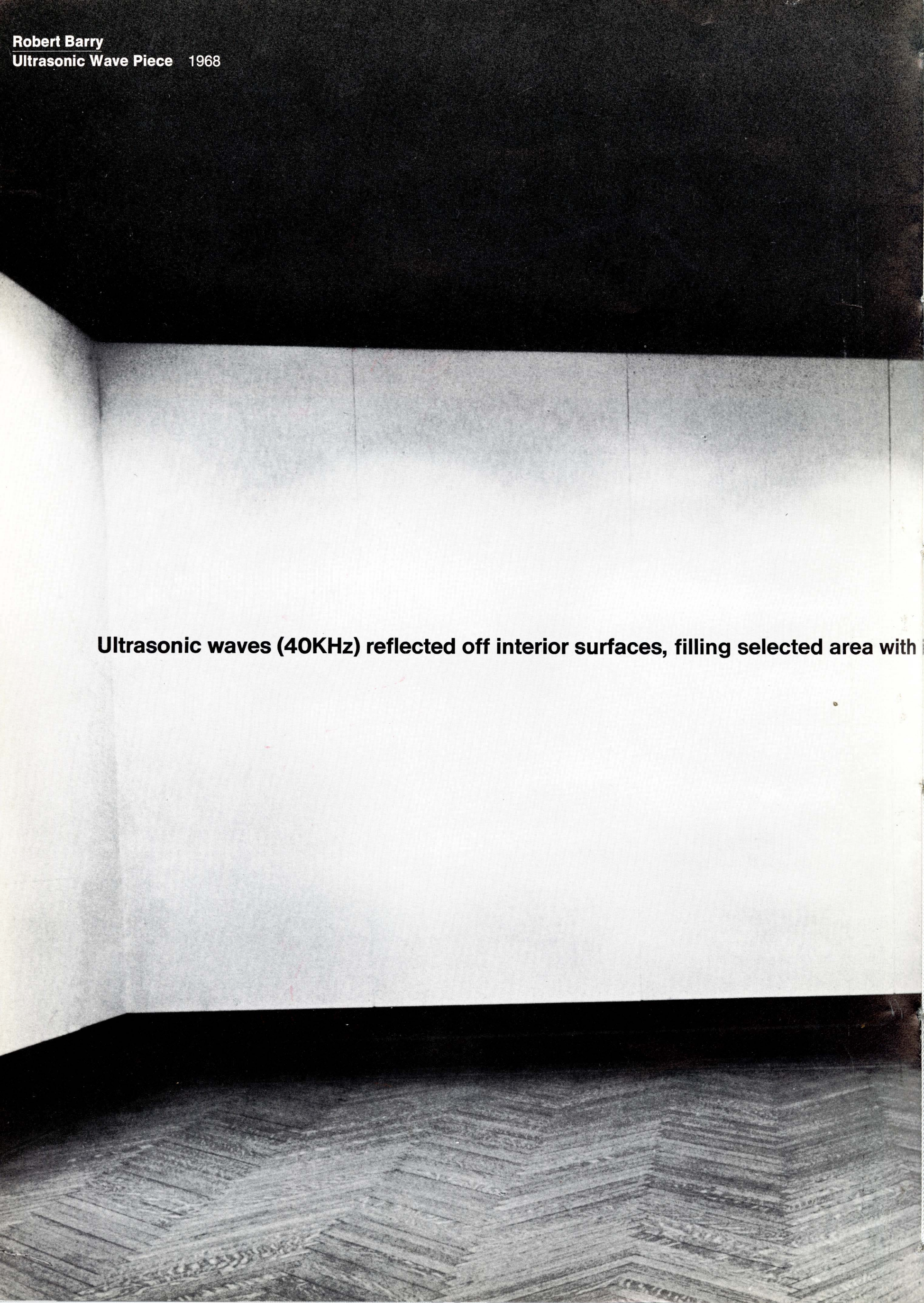
6 betting systems were devised and tested against the results of 82 nights of racing during the Spring, 1970 meeting at Rockingham Park, Salem, New Hampshire.

A description of each system and a chart recording its success (or lack thereof) join with 82 "Official Programs" and this statement to constitute the final form of this piece.

Reality does not lie beneath the surface of appearance. Everything looks like something: every thing is accessible to the purposes of art. No thing possesses special status in the world: nor does man.

I propose that the percipient is the "subject" of art engaged in a self producing activity through language, that has, itself, replaced "appearance" and become the virtual image of the work. Perception then, not being available through normal sensory experience shifts "empiricism" to "metempiricism": concepts and relations conceived beyond objects or material known through experience albeit related to such knowledge.

Robert Barry
Ultrasonic Wave Piece 1968



Ultrasonic waves (40KHz) reflected off interior surfaces, filling selected area with

nvisible, changing patterns and forms. (Space chosen at time of installation.)

Allen Razdow/Paul Conly (Art & Technology, Inc., Boston)
Composer 1970
with assistance from Scott Bradner, Jon Albertson (visual art consultant)
Tonus Inc. (ARP Electronic Music Synthesizer)
Digital Equipment Corporation (time share PDP-8 computer)
Acoustic Research (audio equipment)

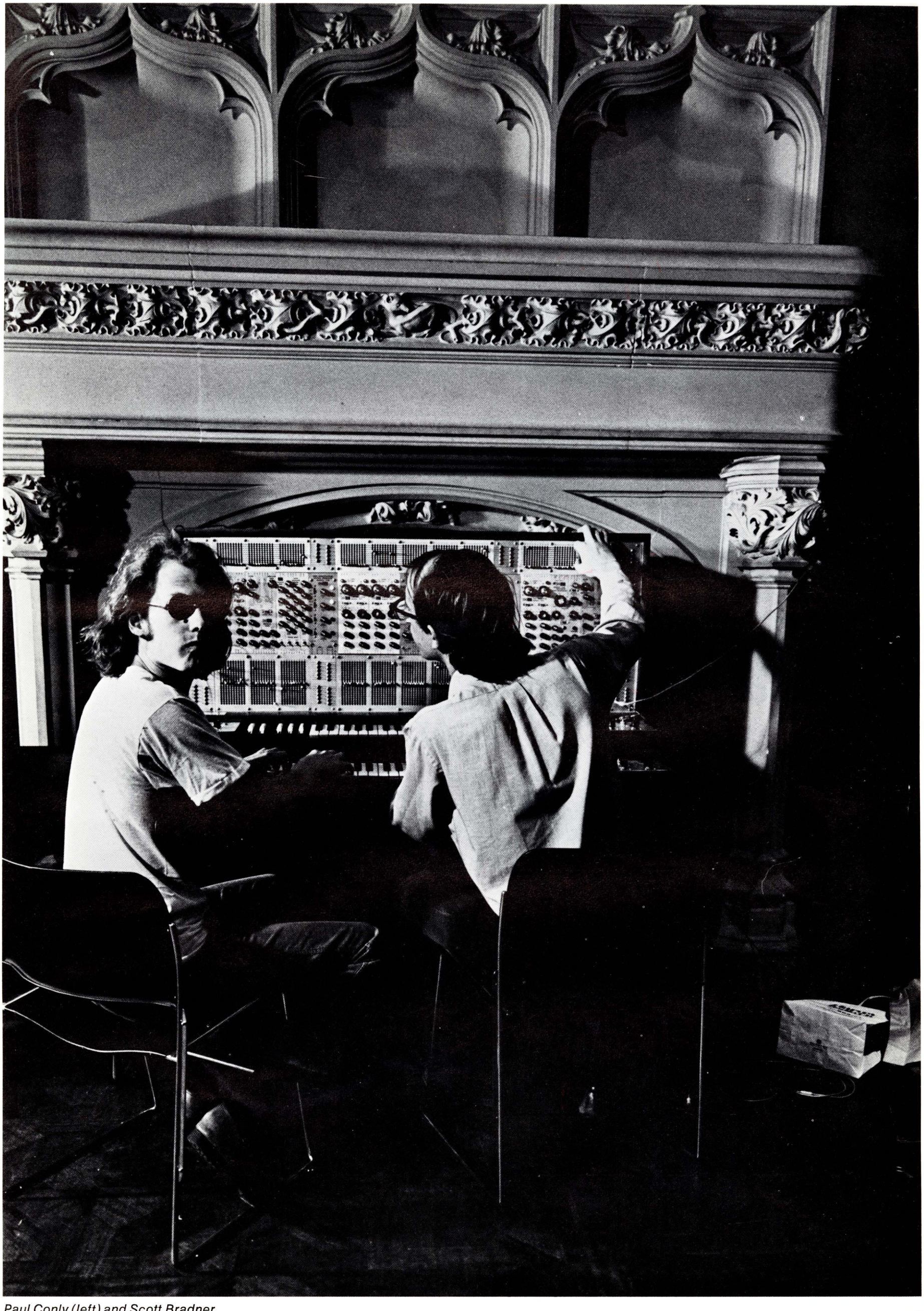
Composer is a study in the possibilities of humans interacting with machines for a creative purpose. It presents the opportunity to share and explore "ideas" with a music composition system, made up of an electronic music synthesizer, a digital computer, and other human beings (plus the equipment that interfaces these participants).

A music synthesizer is an electronic machine that produces all types of sounds by allowing its user to combine the essential elements of sound in unlimited variety. The basic building block is a sound called a sine wave, and any sound whatever may be put together by the proper combination of sine waves: a barking dog, an auto horn, a guitar—these are all comprised of numerous sine waves.

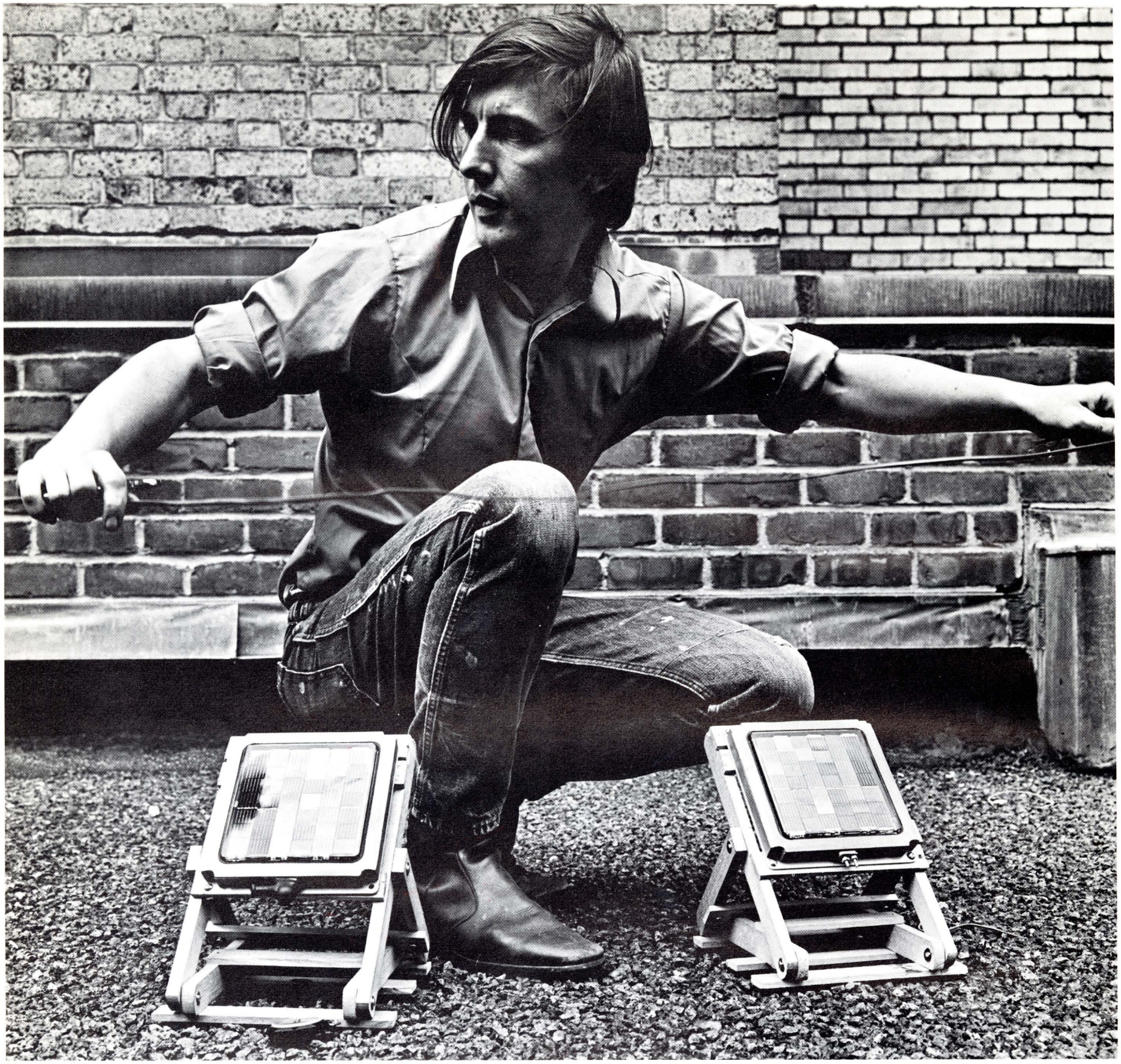
Our system uses the ARP Music Synthesizer built by the Tonus company, and the DEC PDP-8/I digital computer. The *Composer* program instructs the computer to produce sequences of numbers (digits) which are then translated by a digital-to-analog converter into sequences of electrical voltages. Since the ARP is a voltage-controlled instrument, the computer can thus control the Synthesizer.

Museum visitors may contribute their ideas to the composition by directly changing the computer program using electro-mechanical devices in front of four seats in the gallery space. Visitors may also effect changes in the sound quality of the Synthesized music. Four people at a time may interact with the system so that the result is four-voice harmony in quadrophonic sound.

Our own software is what controls this composing system—the *Composer* computer program. The program aims at systematically controlling random events: Is it paradoxical that we can impose a system onto randomness? We set down some musical rules in the program (e.g., "Use a diatonic scale!") and assign numbers to possible musical events (e.g., "a note will sound on the first beat of a measure —80% probability"); then the computer gives us a random list of numbers. When the appropriate number is hit upon as the computer passes out the random list, then the musical event happens in accordance with the program's musical rules. The museum visitors are interacting by changing the skew of randomness of the sequence of numbers that comes from the computer. By the way, this makes the Synthesizer very happy.



Paul Conly (left) and Scott Bradner



Theodosius Victoria
Solar Audio Window Transmission 1969-70

Ten solar battery and radio units will be installed on the roof of The Jewish Museum. The units will be individually connected to the ten panes of glass (including the two doors) at the front of the museum, by means of contact sound reproducers. Each glass surface then will give off sound with low volume information from the solar units above. The information will consist of the following:

1. 147-176 MHz VHF Police and public service radio band. Audio monitor on state and local police, emergency services and civil defense.

2. VHF/FM MHz—U.S. Weather Bureau broadcasting continuous weather bulletins for the immediate area.

3. C.B.S. Television Audio—Participants will listen to television, weather conditions permitting.

4. WINS 1010 AM constant international, national, and local news.

5. 107-136 MHz VHF aircraft band—monitor of pilots, control towers and weather bulletins.

6. ABC Television Audio.

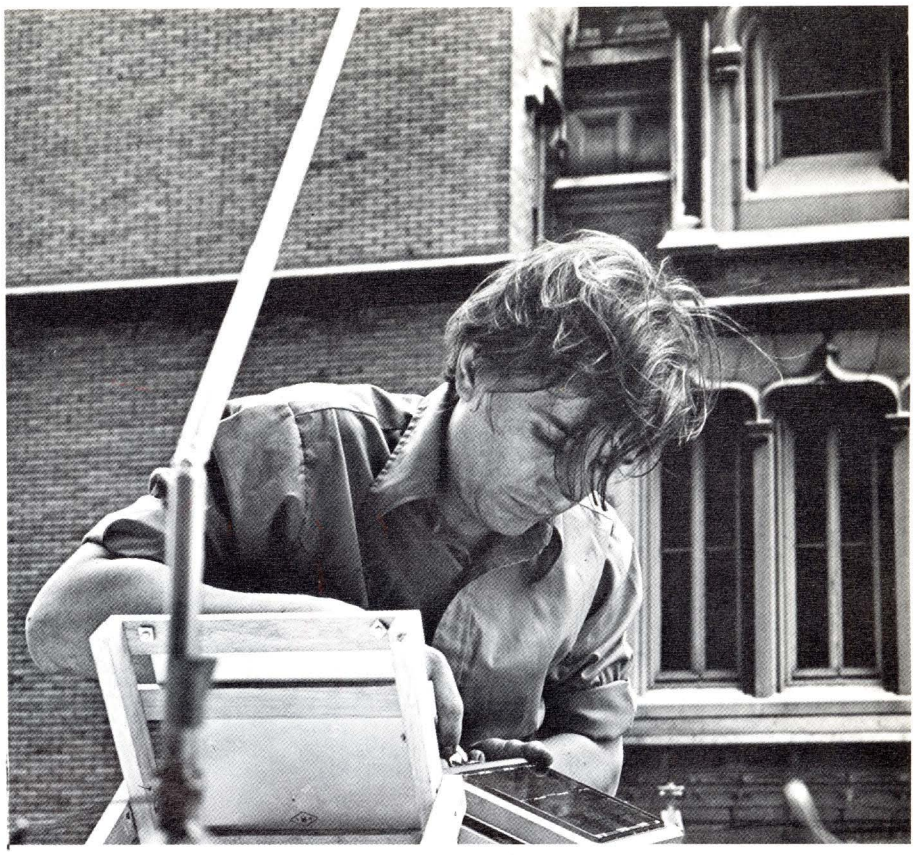
7. 29-50 MHz VHF Police/Fire audio monitor of mobile phone and medical services, vehicular communications, fire and police emergency situations.

8. VHF/FM 162.55 MHz constant weather broadcasts.

9. N.B.C. Television Audio.

10. WCBS 880 AM constant news broadcasts.

Participants will be expected to search out sounds along the front of the museum. The position of the sun along with weather conditions will determine which of the units will operate. Of course the piece will not function at night or during inclement weather. Consult your local newspaper as to the times the piece will be in operation (i.e., times of sunrise, sunset and weather forecasts).



One word leads to a story

David Antin

The Conversationalist 1969-70

Anyone entering the museum can enter the Conversation Room but they must enter it one at a time because it is a private though not necessarily intimate experience. Whoever chooses to enter the room will hear on entering a tape recorded message to the effect that, "If you wait a moment you'll hear a word. If you feel like it, listen to the word and then pick up the microphone and tell a story using the word. It would probably be more interesting if the story you tell is a true story, but that's up to you. Take as much time as you need to feel comfortable before beginning to speak. When you're through talking put down the mike and you'll be able to hear the work you've been part of." After he's finished talking the person will hear several other peoples' stories and finally his own, after which he leaves the room and someone else can come in. On some days whoever chooses to enter will hear two words or three words rather than one word. This will probably make it more difficult to tell a story, especially a true story, and will certainly take more time. Because of this the piece will use a voice-actuated microphone, so that very long hesitations will not be recorded. If anyone finds the task painful or too difficult, he has, of course, no obligation to play.

"Conversation is an improvisation on a limited number of words partly determined by the person you're talking to and partly by the weather." If somebody said that to me I'd have a strong tendency to answer with some of the same words, even if I intended to disagree or change the subject, e.g., "Yes, but I can ignore the weather." or "No, it's not the weather at all..." and so on. What I want to do is take a list of words (about 10 of them) and present them 1 by 1 to somebody for a free improvisation, "a story", to make a poem, a stochastic poem consisting of a sequence of stories potentially 5 hours long on any given day, all of them built around the same word. It is something like crystal seeding. Take the word "born". It might yield a series of stories like:

> "... She fought it out for three days and by the fourth day when she was ready she thought the hell with it and the baby was born with whatever anesthetics they wanted to use."
>
> "I was born on D-Day."
>
> "My mother said she was born on Christmas and my aunt said she was born on Easter. I thought everybody I knew was born on a holiday until somebody told me that in the old country they had so many children they never paid attention to real birthdays they just adjusted them to the nearest holiday."
>
> ...and so on

Vito Acconci
Room Situation (Proximity)

Project:
Standing near a person and intruding on his personal space.

Possible realizations:
1. Every day, for the entire day, I will be present at the exhibition area, going randomly from room to room. At various points, a subject will be chosen who is standing in relative privacy at one of the exhibits: I will stand beside him, or behind him—closer than the expected distance—crowding him. (I can stand near him until he moves away.)

2. When I cannot be present at the exhibition area, a substitute will be assigned to perform the activity.

3. I will be present at the exhibition area, performing the activity, whenever I can; when I cannot, the statement will continue to present the possibility of the piece.

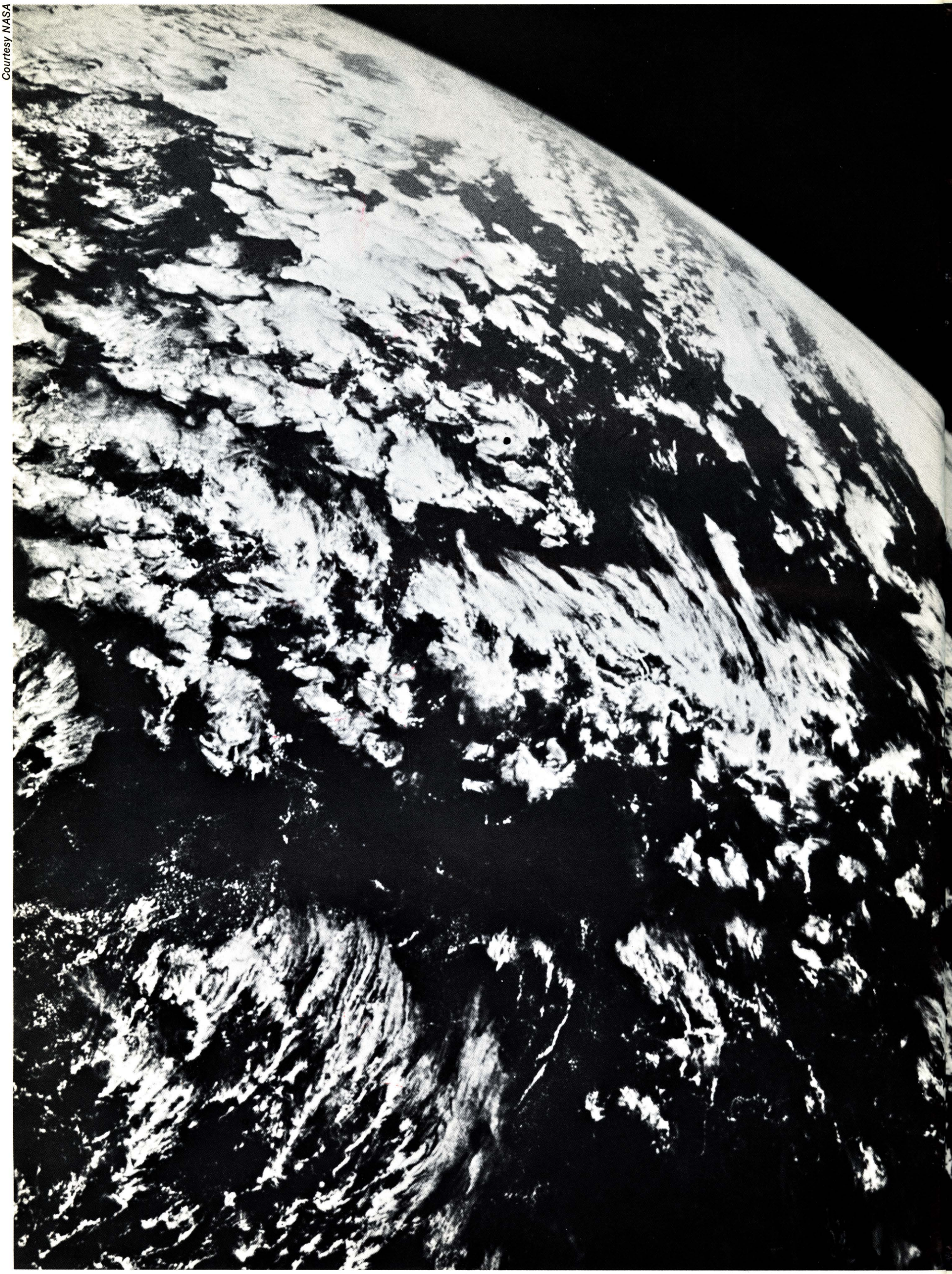
Lawrence Weiner

An Accumulation of Information Taken from Here to There 1969

Collection Gian Enzo Sperone, Turin

1. The artist may construct the piece
2. The piece may be fabricated
3. The piece need not be built

Each being equal and consistent with the intent of the artist
the decision as to condition rests with the receiver upon the
occasion of receivership



Courtesy NASA

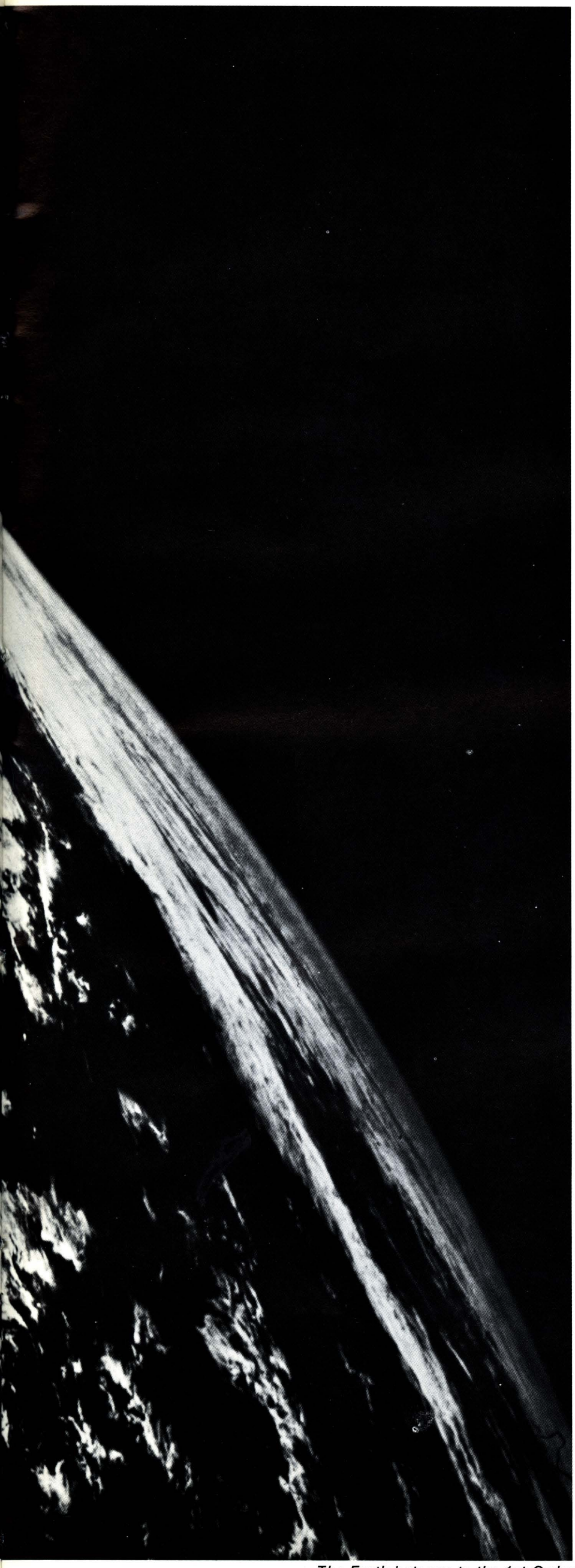
Donald Burgy/Robert Duncan Enzmann
Order Idea 1969

Order Idea is a systematic description of the universe, extending from the smallest known entities, the fundamental particles which comprise the atoms, through the hierarchy of organized matter, to the largest currently perceived entity, represented by the optical limit of the universe.

The hierarchy is divided into orders. An order, and the entities which comprise it, may be thought of as a level in a river-like cascade of "periodic tables" with each level comprised of smaller structures. Atoms are comprised of their fundamental particles, molecules are comprised of atoms, and so on, to increasingly larger structural orders. The sizes, shapes and durations of things are a result of the fundamental structure of the universe; the sizes, shapes and durations of entities within a particular order are imposed as a function of the entities' composition and the external, internal and stored energies acting upon it. The entities within orders have relatively long durations and may be compared with the horizontal levels in a cascading stream. The relatively rapid reorganizations of matter to form larger (lower order) or smaller (higher order) entities may be seen as the vertical falls of a cascading energy stream flowing from an unknown thermodynamic source to an unknown thermodynamic sink.

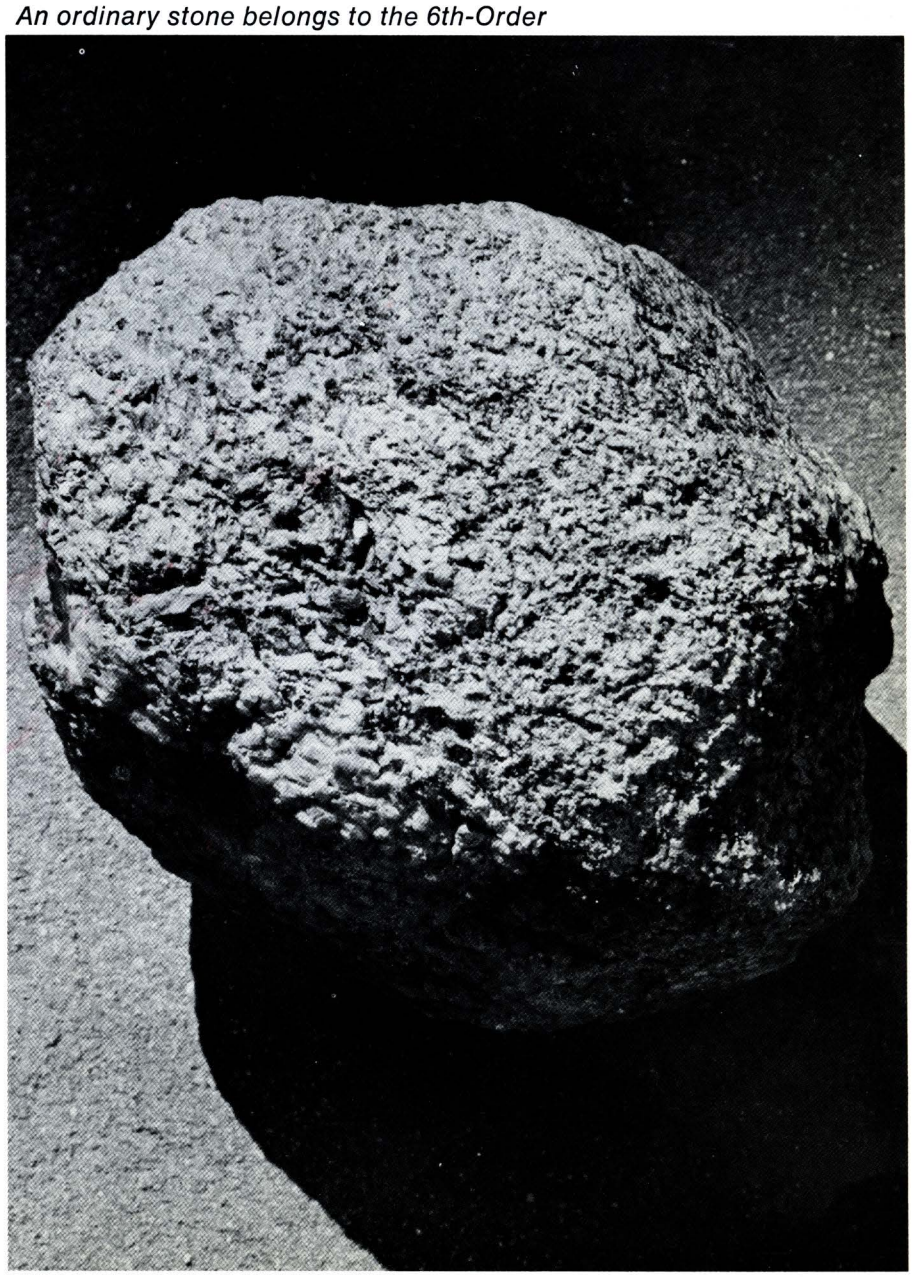
An example of solid matter "flowing" in a source—sink cascade on earth is: The 1st-Order stone shell of the Earth is heaved into 2nd-Order continental platforms and oceanic basins by the internal forces of the Earth. The continents are worn into 3rd-Order belts of plains, hills and mountains by rains driven by the Sun, even as the continents are lifted by forces within the Earth. Single 4th-Order mountains are broken into 5th-Order masses and boulders by frost, rains and impacts. These masses are broken into 6th-Order pebbles and 7th-Order silt which flows to the sea to be reconstituted again into the rocky rim of the mother continent.

Order Idea, and the visual, verbal and mathematical statements which comprise it, is a description, not an explanation, and represents a cross-section of a model of the universe intersecting perpendicular to its time-line and describing only selected events within one state of matter at the moment the events flow through this cross-sectional plane.



The Earth belongs to the 1st-Order

An ordinary stone belongs to the 6th-Order



Donald Burgy

Selected Mental & Physical Characteristics of Donald Burgy 1970

Name: Donald Burgy

Birthdate: August 3, 1937

Residence: Bradford, Massachusetts

Work: Documentation of selected mental and physical characteristics of Donald Burgy from 1/20/69 to 1/30/69
Body measurements
Body photographs
Dermatology report
Electrocardiogram
Electroencephalogram
Family medical history
Laboratory reports
Minnesota Multiphasic Personality Inventory
Ophthalmology report and photographs
X-rays

Donald Burgy

Question-Answers 1969

Questions: Donald Burgy
27 Kingsbury Avenue
Bradford, Massachusetts

Answers: Douglas Huebler
6 South Park Street
Bradford, Massachusetts

Polygraph: James Tierney
Dan Sullivan Agency
89 State Street
Boston, Massachusetts

Date: March 20, 1969
7:00 p.m.—9:00 p.m.

Donald Burgy

Time-Information Idea No. 2 April, 1969

Select, at random, seven different things, events or ideas.
Study the seven selections until you discover one factor common to all.
Record that factor.
Repeat this process once each day for one week, without ever repeating a selection or a common factor.
Reduce this group of seven to one common factor.
Record the information on a post card and mail to:

Burgy
294 South Main Street
Bradford, Massachusetts 01830
U.S.A.

The reduction of information will be completed when one final factor is distilled from the many factors mailed to the artist.

Courtesy the artist

Scott Bradner/Jack Nolan (Art & Technology, Inc., Boston)
Floor Show 1970
Design assistance from Robert Kieronski and Robert Lentz
Module design and construction by E. James Horn
Digital Equipment Corporation (time-share PDP-8 computer)

Floor Show is an attempt to simulate instinctual behavior of living beings with a computer and a visual observation system. Fish are chosen because of their highly instinctual behavior. The museum visitor may interact with the system in order to introduce some non-instinctual behavior into the actions of the simulated fish.

The fish are represented visually by spots of light projected onto the floor. Their movements are controlled by the computer, using preprogrammed simulation parameters and directions by the participant.

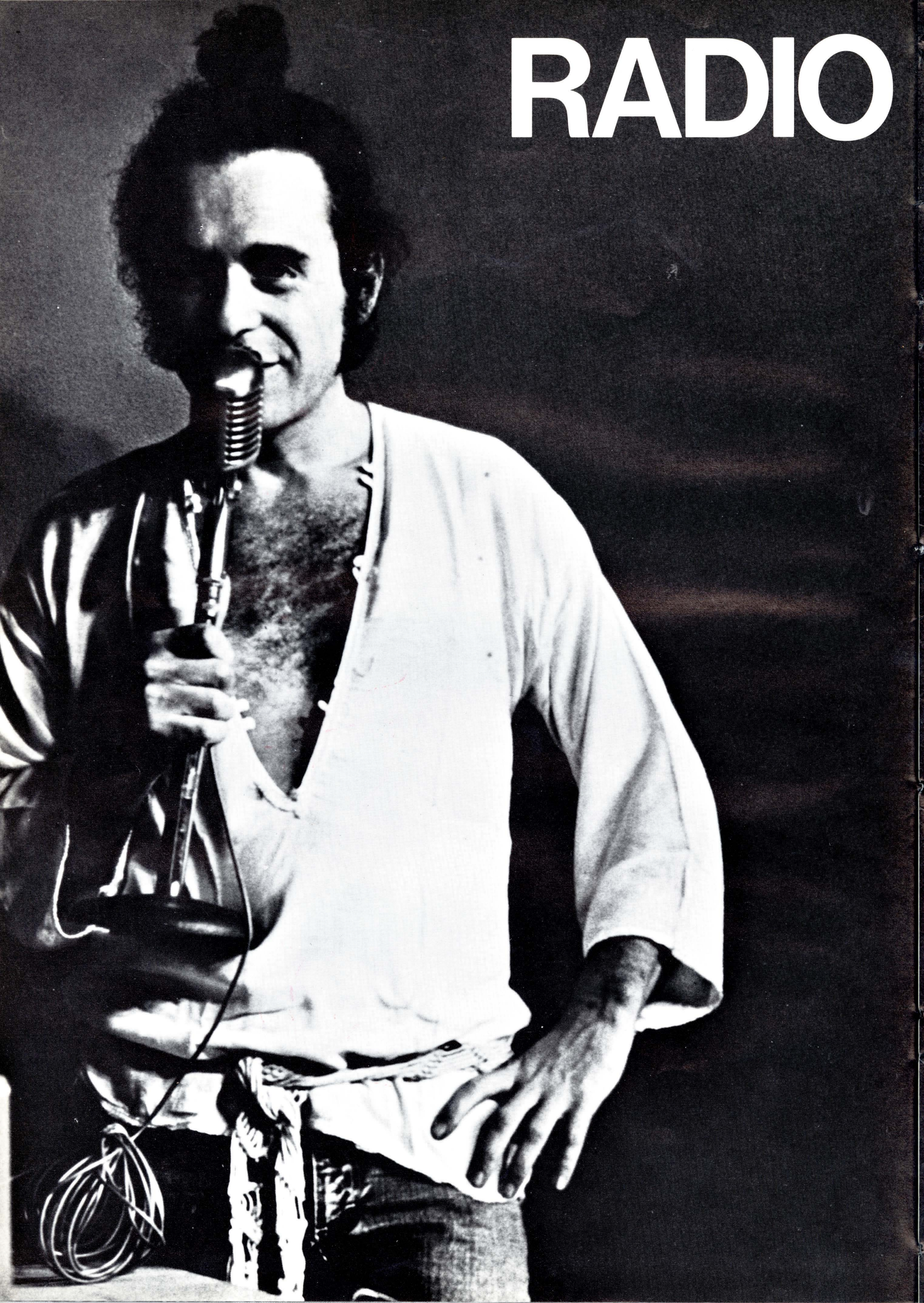
Four of the simulated fish are totally controlled by the computer, using information on the proximity and motion of the other fish. The other four are directed both by the museum visitor and by the computer's simulation of instinctual behavior.

exhibited in Washington, D. C. only

A School of Spadefish

Fritz Goro, LIFE Magazine © Time Inc.

RADIO



FREE POETRY

Tune in at 800 AM on your dial at The Jewish Museum
or 610 AM on your dial at The Smithsonian Institution

We will broadcast continuously inside the museum the works of poets, which will be picked up by visitors on transistor radios with earplugs given out at the front desk. The programs will be 1½ hour tapes played on an automatic-reverse tape recorder. Each poet will be on for 15 minutes and there will be six different poets each day. The tapes will be changed daily.

Giorno Poetry Systems

Vito Acconci
John Ashbery
Bill Berkson
Ted Berrigan
Joe Brainard
Michael Brownstein
Antonin Artaud
Jim Brody
John Cage
Jim Carroll
Joe Ceravolo
Eldridge Cleaver
Kathleen Cleaver
Andrei Codresco
Clark Coolidge
Diane Di Prima
Kenward Elmslie
Larry Fagin
Dick Gallup
Allen Ginsberg
Giorno Poetry Systems
Barbara Guest
Brion Gysin
David Henderson
Abbie Hoffman
Lenore Kandel
Kenneth Koch
Timothy Leary
Lewis MacAdams
Jackson MacLow
Gerard Malanga
Bernadette Mayer
Taylor Mead
Renfreu Neff
Frank O'Hara
Joel Oppenheim
Ron Padgett
Lennox Raphael
Jerry Rothenberg
Aram Saroyan
Peter Schjeldahl
Jerry Rubin
Bobby Seale
John Sinclair
Gary Snyder
Tony Towle
Tom Veitch
Diane Wakoski
Anne Waldman
Lewis Warsh
Andy Warhol & Bridgit Polk
John Wieners
Emmett Williams
and others

Guerrilla Radio

Giorno Poetry Systems

Various transmitting equipment has been checked out, the most efficient assembled and operated at The Jewish Museum and The Smithsonian as a test guerrilla radio station. We processed out the problems and developed systems of programming, so that with simple instructions, anyone anywhere can set up a transmitter and start broadcasting.

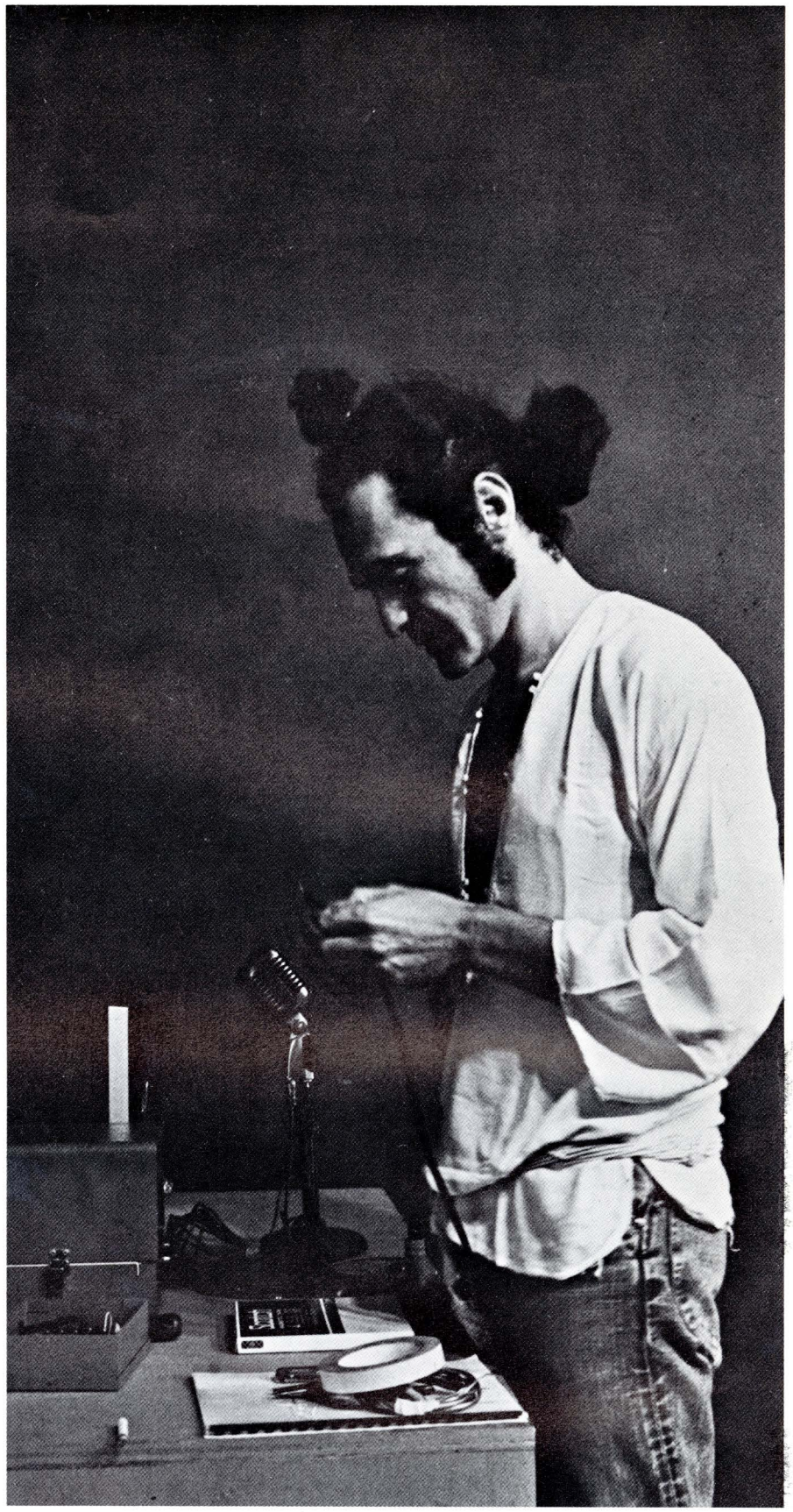
Under FCC Low Power Transmission Regulations, it is legal to broadcast on the AM band without a license, if one transmits with 100 milliwatts or less power in a free space, not interfering with licensed stations, and have a 12 foot antenna or use carrier-current transmission. *How to do it:* buy the AM transmitter manufactured by Low Power Broadcast Co., 520 Lincoln Hwy., Frazer, Penna., 19355. Tel. no.: (215) Ni 4-4096. The guy to speak to is Dick Crompton. The transmitter costs $199 plus $30 for the capacitor, if you're going to do carrier-current. Other equipment needed: a microphone and tape recorder (the better the quality, the better the broadcast quality), an AM radio, and depending on how much bread you have, one or two turntables, a mixer and more tape facilities.

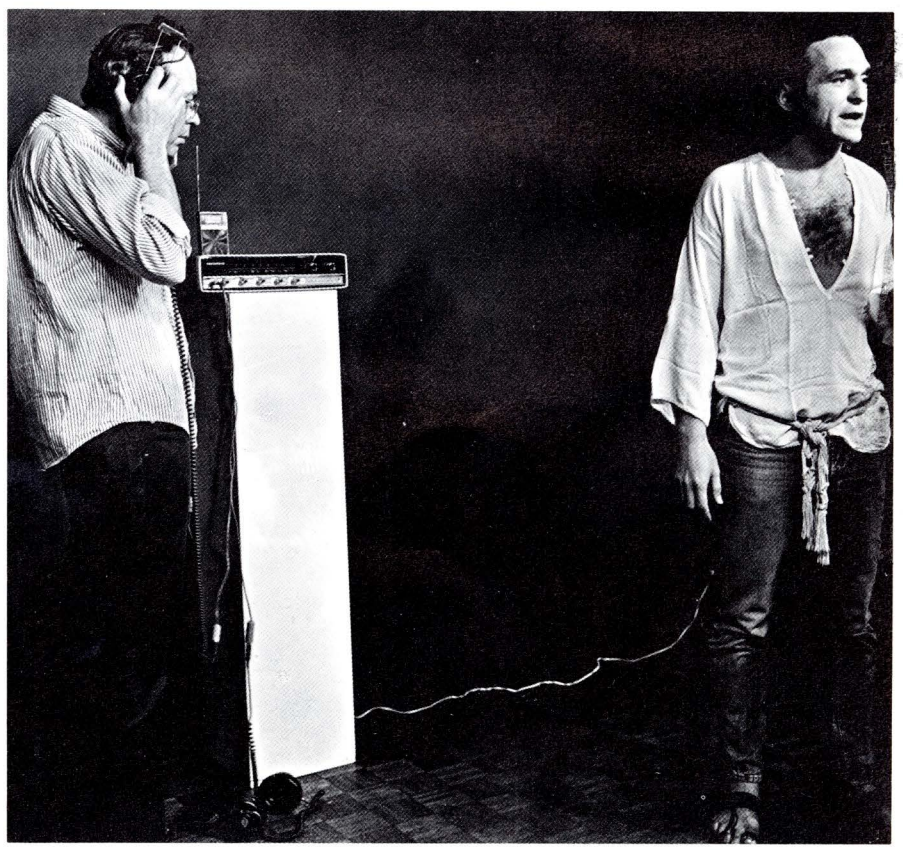
Carrier-current transmission is being used in the *Software* Show. The transmitter with the capacitor plugs into a wall outlet, drawing its power from the line like any electrical appliance, and feeding its signal into the power line so that the signal can be heard on any AM radio (transistors, etc.) tuned into the operating frequency of the transmitter. The frequency is adjustable to a clear broadcast frequency in your area. The signal will travel on the electrical wiring until it hits a transformer, where it is wiped out. There are transformers every couple of blocks or in one large office or apartment building.

In using a 12 foot antenna, there is also the limited range of a few hundred feet or a couple of blocks. However, increasing the length of the antenna radically increases the range of reception. Penalties for knowing violation of FCC regulations are heavy. At St. Mark's Church, we ran the antenna to the top of the bell tower and as we were testing it out, these two guys in blue business suits and grey crew-cuts, came in and said "We're looking for John Giorno." They flashed their badges and said, "We're from the FCC." They checked everything out and suggested the antenna be cut. One of them got up to me real close, looked in my eyes, smiled and said warmly "This is just a warning. If you violate it, it means a $10,000 fine and 10 years in prison." So we cut the antenna and hooked up the transmitter to the organ pipes. You can also use the heating pipes in a building for transmission. They had apparently come because Howard Smith had written about Guerrilla Radio in The Village Voice that week. Since then we've heard that the FCC won't hassle you, if you don't advertise or become commercial and are not in competition with licensed stations. We hear kids in Connecticut have a hundred foot antenna and are broadcasting over a 30 mile area. Be sure they will hassle you if it's a political trip.

Other ways of extending your range is to send your signal over the telephone lines to other transmitters which will broadcast it immediately. Perhaps in several areas in one city and from one city to another. There should be an exchange of tapes and information between guerrilla stations. Also it is possible to be mobile, broadcast from a truck and keep moving. The FCC has equipment that can pin-point the source of a signal in 15 minutes. Guerrilla Radio will be a web or grid of small radio stations linking everyone across the country and having no center.

The airways are free. The airwaves belong to the people.





Nam June Paik

...confessions of a 'cafe revolutionary,' May 1969

Letter from the artist in response to a request to participate in *Software*

Dear Susan:
As you see,
I am very lazy man. . . . .
just Cafe revolutionary. . . . .

Village Voice reader///

I have waked up noon. . . on a beautiful
Monday morning.

How much work I have DONE !!!
I picked up mail.
sent 1 $ 37 ¢ to Reader's Digest, because
they scared me to send me law enforcement
officials.
I had swallowed 99 ¢ lunch at DAVE's corner
made two phone calls and it is the third letter
to write

. . . . . it is already 3 PM. .
time for nap. . .

maybe I read too much FEIFFER cartoon

if I were not lazy. . . .

i would be teaching Gregorian Chant in the
National University of Seoul
in the Great Republic of KOREA,
to underdevelop our developed cultural heritage. . . .

flying Korean National Airlines
(c-37 WW II—transport plane)
. . . . . .

John Cage said. . Venice is the most advanced
town in the world, because it has abolished
automobile. . .

According to this theory
Korea is most advanced country, because it
legalized POT.

our peasant is growing pot and selling openly to
G.I.'s. . . since no Koreans know what it is
how to enjoy. . . there is no law to prohibit. . .

and our country is the only producer of
Ginseng . . . new darling of hippie

and my father was salesman of that Ginseng. . .

it is, how i could get exitvisa
from my beloved country and
skipped draft and glory of

dying for the Freedom and democracy

well, Have I read too much
Jill Johnston????

I am so lazy that I postpone a letter, which could be
just three lines, but end up writing 3 pages
apology. . . .
it helps to exercise my English
. . . . . .

Enclosed are
1) CONFIDENTIAL PLAN OF STP COLOR TV synthesiser.
two versions of essay, of which one chapter is dealt
with Input-Out unit/
there are some more hippier projects, which I
will tell you in August. . . I think, I better
visit you personally, in August, Because I move
to Boston at the end of August. . .
Korean astrologer said that Lindsay will win with big margin,
provided he drinks Ginseng tonic every morning. .
SWITCH TO EVO

Visual images make a real impression

Linda Berris has a feeling for tactile-films.

Smith-Kettlewell Institute of Visual Sciences
Vision Substitution System begun in 1959

This strange wheel chair with electronic components on its back and a television camera attached is the prototype of a Tactile Vision Substitution System being developed at the Smith-Kettlewell Institute of Visual Sciences, Pacific Medical Center, San Francisco, California. It is the work of a team of scientists including Paul Bach-Y-Rita, M.D., Carter C. Collins, Ph.D., and Benjamin W. White, Ph.D.

The System is designed to take an image picked up by the television camera and transforms it into a tactile image on the 400 vibrators mounted on the back of the wheel chair. A number of congenitally blind young people have been using the System, performing various experiments designed to see what the capabilities and limitations of such a device are. The hope is that such a machine may enable the blind to receive information by way of their skins which the sighted person would normally receive through his eyes. Thus far these blind subjects have been able to identify three dimensional objects and letters of the alphabet. Some are now able to discern the arrangement of several objects on a table top, correctly telling which one is in front and which in back. The limitations of the system encountered to date appear to be attributable to the crudeness of the device rather than to inherent limitations in the human skin as a channel for receiving visual information.

The tactile image, simulated here on the seated girl's bare back, corresponds to the visual image on the screen.

Linda Berris
Tactile Film

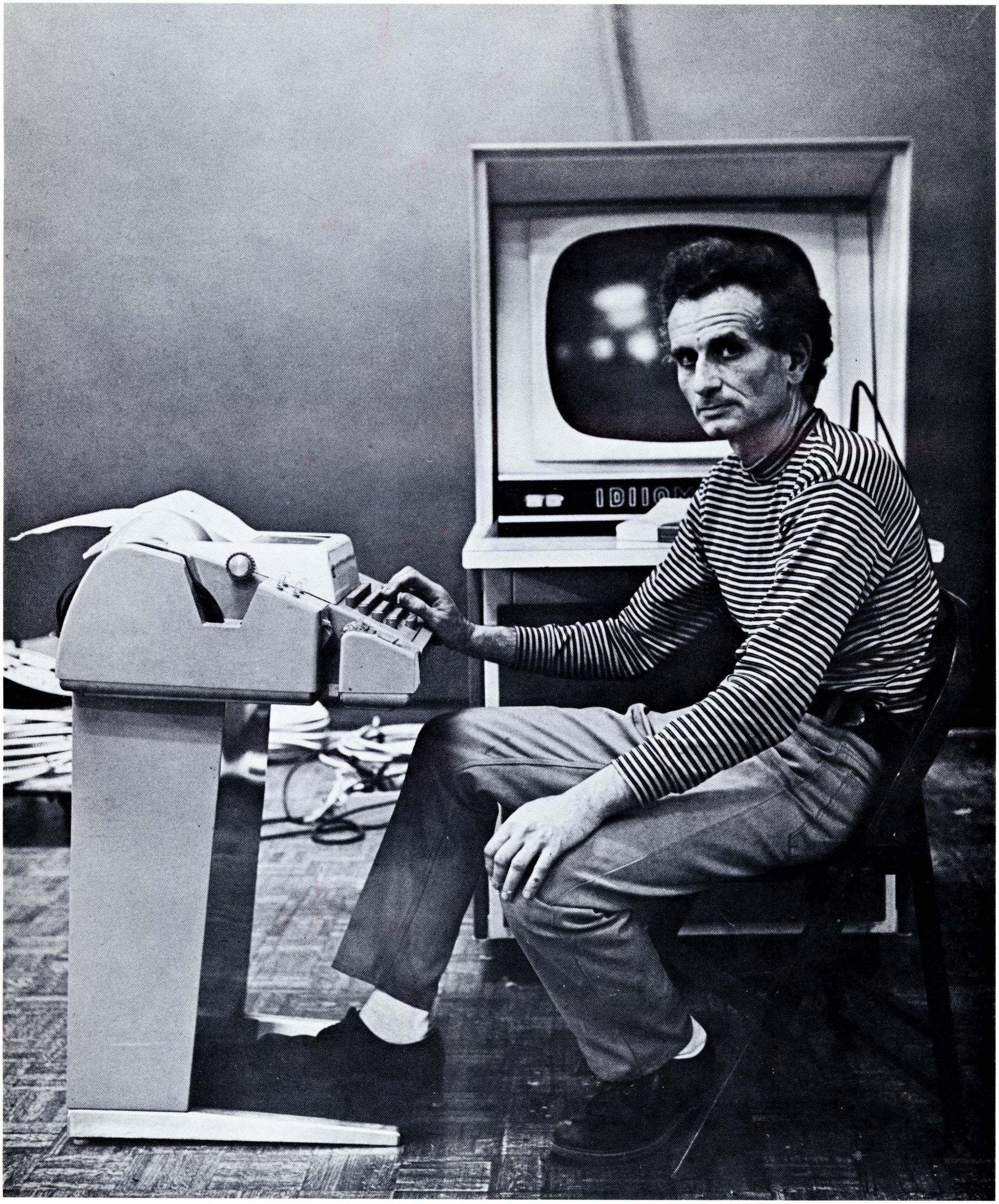
This is the first motion picture created to be *felt* as well as seen and heard. It is designed to be played back through the Vision Substitution System, which converts light images into tactile dotted images. Use of the System to transmit specially designed motion pictures is a new application for this System—one which is not part of the basic laboratory research. Work on the present film began over a year ago when Linda Berris conducted independent explorations to find out what kinds of images and movements could be most successfully conveyed through the System. The film reflects her findings in this personal project.

The film is both an explanation and a work of art. Poetic images are used to suggest scientific concepts related to touch and other senses and to demonstrate some of the possibilities of the System. The sense of touch is the primary consideration in the organization of the film and in the design of each image. Simple abstract forms—such as lines, circles, and squares—convey the meaning of the film in universal symbols. (To identify more complex shapes, participants would need hours of training with the System.)

William Vandouris
Light Pattern Box (Electrochrome)

The Electrochrome is a type of visual organ or piano. When the viewer presses one of the keys on the keyboard, a pattern of colored lights appears on the screen. He can play in any rhythm he likes, or he can set the machine to change patterns automatically. The Electrochrome, an independent project of William Vandouris, was designed for use by the sighted. The Electrochrome is not part of the basic laboratory research being conducted with the Vision Substitution System. However, combining the Electrochrome with the Vision Substitution System in this exhibit enables participants to choose patterns which they can feel on their backs as well as see.

The message behind the media



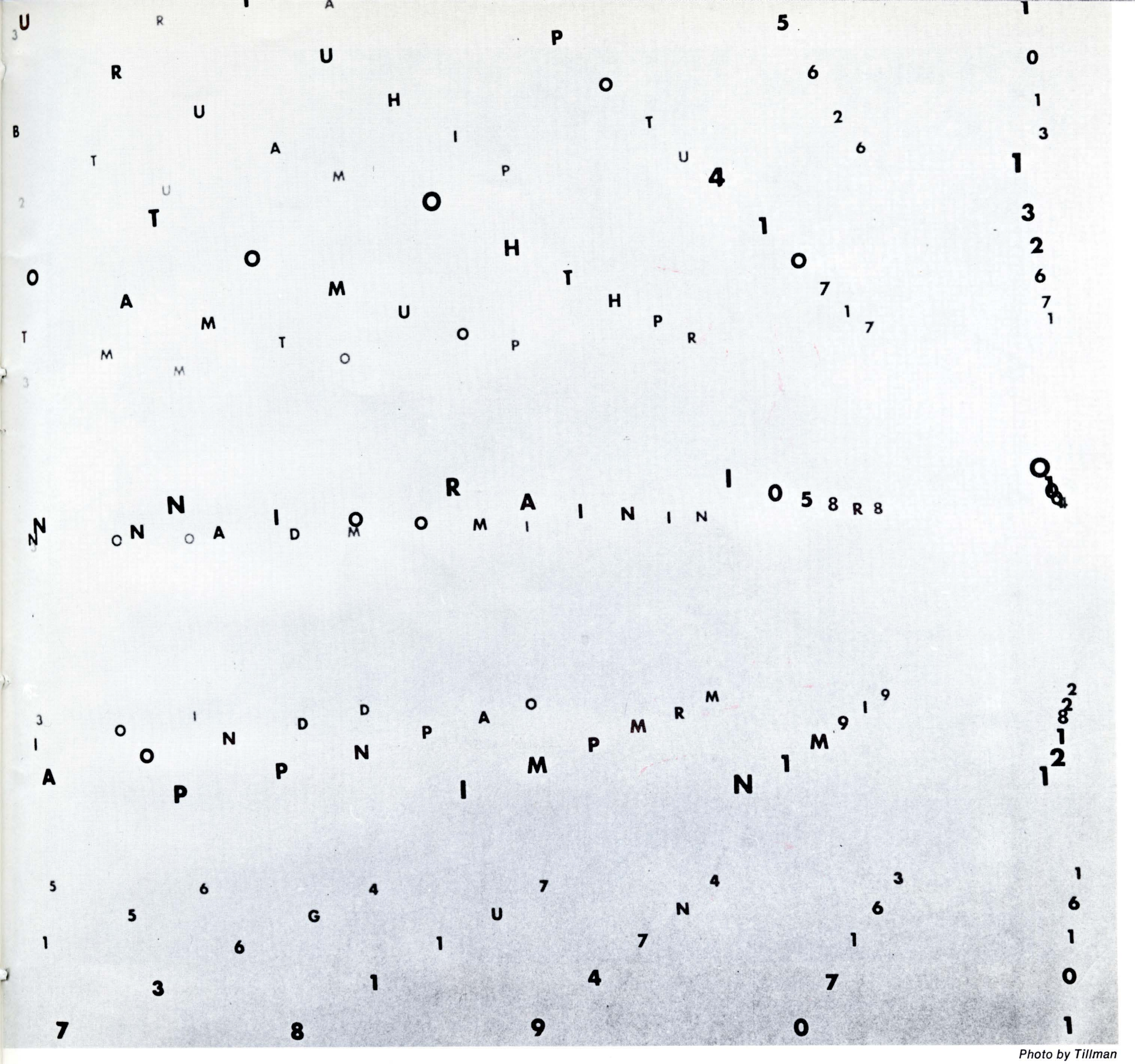


Photo by Tillman

Carl Fernbach-Flarsheim
The Boolean Image/Conceptual Typewriter 1970

We are surrounded by a causal reality, bordered by our concepts of birth and death. Inside this reality we stabilize ourselves by making decisions. The Boolean Image is a matrix built upon this supposition. It is a womb containing decisional cues. These cues are neutral elements placed into specific relationships with each other. On these elements we hang decisions, labels which make them into anything we decide them to be. Since such decisional cues often occur in relational groupings or sets the matrix was named after George Boole, the originator of set theory.

The Boolean Image is the esthetic. It is the ground upon which we make the rules for the game. It is the message behind the media. The neutrality of its cues can easily be mistaken as being meaningless or trifling.

Computer realizations displayed on the scopes in this exhibition are based upon Boolean Images whose decisional cues are alphanumerical. The computer can most easily sense this type of cue and convert it into the decisions of the artist, programmer, audience-collective.

Boolean Images may not be immediately perceivable. In the *Conceptual Typewriter* program the Boolean Image is fairly easy to recognize.

The Boolean Image can also be understood as a medium in its own right, as shown in the photographs. While software might be thought of as a psychic integration of our own biological DNA program, the Boolean Image might be thought of as sensing into the nature of this program, by dealing with the triggering devices of which it is composed.

Note: *Conceptual Typewriter* is effectively table-driven from a scheduler (a virtual time-table), but packed into a curious list structure as well, for the handling of interactions and animations. This computer display was done with the assistance of The R.E.S.I.S.T.O.R.S., Pennington, N.J.: John Levine, Nat Kuhn, Peter Eichenberger & Lauren Sarno.

The Conceptual Typewriter may be thought of as the instrument created when the "Conceptual Typewriter" program is loaded into the IDIIOM. Ten illuminated buttons on the control button-box represent ten concepts suggested by the *I Ching*. The viewer may add concepts or replace them with the buttons, or alter them with the light-pen.

The IDIIOM, a dynamic display with its own built-in computer, is on loan from Information Displays, Inc. of Mount Kisco, New York.

Evander D. Schley
Software Films 1969-70

The films represent both the views of the participating artists on the nature of *Software*, accomplished through direct interviews and group discussions, plus on location filming of the artists in their working environments. Emphasized is the particular relationship of the artist to the computer and other less sophisticated machines as opposed to the utilitarian and commercial usage for which they were originally intended.

The films will make no direct statement. Their purpose lies in accumulating the data forwarded by the participants in the show and disseminating it continually to each entrant to the museum. There will be no beginning nor end. Each will be simultaneously projected on a continuous loop.

The techniques employed by the films are straightforward in the "cinéma verité" tradition; no tricks or gimmicks are used. Since we were shooting at a ratio of 10-1 it was possible to explore informally the views of the artists which should provide insights not normally achieved in more structured interviews. The informality should assist the viewer to grasp the nature of his technological environment by the exposure of various aspects of it being used in ways to which he is unaccustomed.

The shooting schedule was spread out over an extended period, so that the crew with the assistance of the exhibition coordinator could arrange the most interesting and relevant coverage of the process of the exhibition in addition to the interviews, discussions and location filming.

Sponsored by Dr. Sanford Greenberg

Allan Kaprow
Work A Happening
September, 1969

1. A basement hallway is painted, and repainted, by professional contractors every Tues., Thurs., and Sunday, for three continuous weeks. Sprayers, rollers or brushes may be used.

2. Color for successive coats of paint to be chosen on the spot by the sponsors, at completion of each stage. Discussions with painters.

3. Whole process recorded on color video (with cooperation of painters). Transmitted live on full-screen enlargement for one week each, as a "selected short subject", at the following types of movie houses: a) art films, b) skin flicks, and c) regular run theaters.

4. A slide transparency, superposed on each day's transmission, will read: " 'Painting a Hallway' by *(Name of painting contractor)"* thus providing him with free advertising. Painters will be free to demonstrate their skills, dedication and honesty, as well as make commercial spiels for their company.

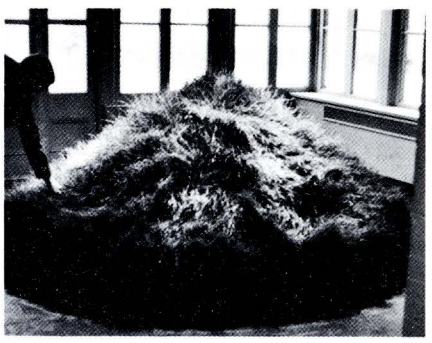
5. Broadcast time each night is exactly one half hour, say 7:00-7:30 P.M. Painting time, including setup and cleanup, about one and a half hours, say from 6:30-8:00 P.M. Video technician's time, about the same, assuming equipment is set up in place at beginning of each week.

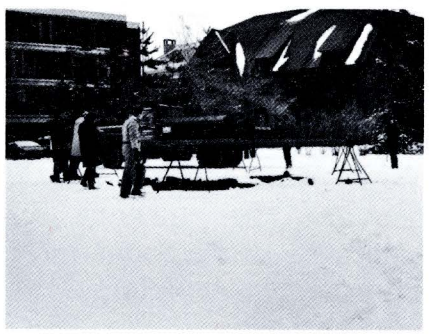
6. Ads will be placed in advance in the classified columns of newspapers and upon the bulletin boards of schools and shopping centers saying: "Painting a Hallway—Underground Film, at 7:30 P.M. at the *(name of theater),* Tues., Thurs., Sun., *(dates),"* thus giving the theater its advertising. Other ads will state that "Jewish Museum sponsors avant-garde television. For information call RI 9-3770". A pre-recorded answer will tell about the Happening and direct the caller to the theater of the week. Thus the Museum will be advertised. The name of the artist need not be mentioned in any of this. But in a different area of communication, namely that of the arts journalists, his name may be mentioned. Thus he will get his advertising, too.

Brief Observations about Work:

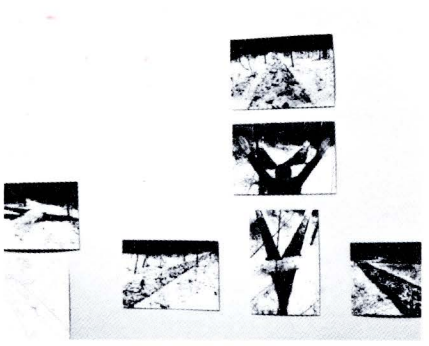
- A room is repainted over and over again when it doesn't need it.
- A live TV activity, i.e. video-vérité, is received as a pre-shot movie (cinéma vérité).
- A roughly similar Happening program is presented in three different socio-cultural contexts: arty, pornographic, and middlebrow.
- Real time is introduced into fictional time of the movie audience for whom the convention is to suspend the real; while for the painters, fictional time is introduced into real time, since the ordinary job has been made for them pointless but perhaps flattering, in view of its new function as communication.
- Information is less a matter of direct conveyance than it is a reprocessing and alteration: a hallway is repainted any number of times. The paint job is *re*created literally and in the minds of the painters and others who are informed: it, therefore, becomes *recreational* instead of laborious....
- A presumptive work of art becomes a business commercial. But the advertising engaged in is so minimal and so misapplied that it becomes an absurdity (like repainting a room continuously). Hence, recreation, again.
- A museum presentation is accessible only at other non-museum showcases. In either case the institutions are engaged in "abnormal" functions.

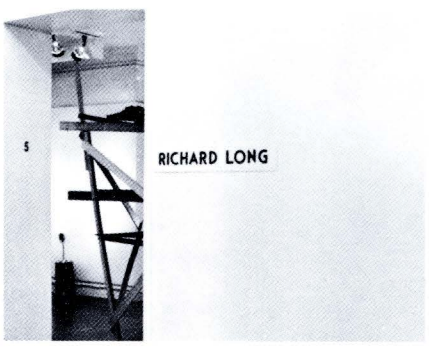
DENNIS OPPENHEIM

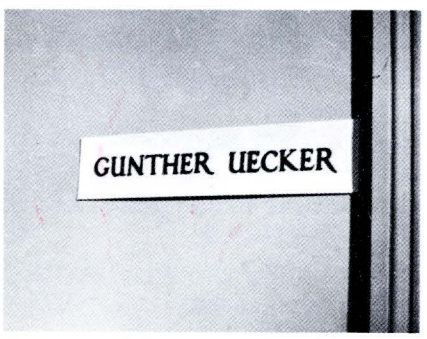


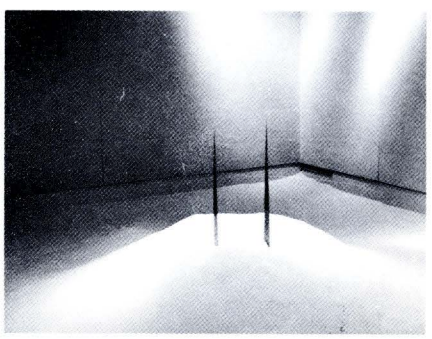


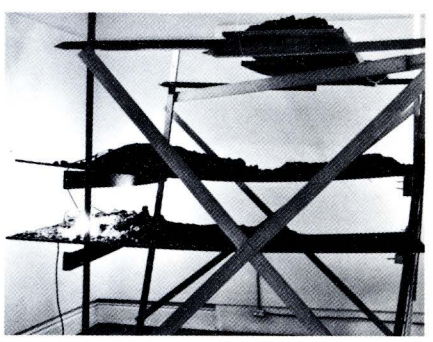
EARTH











Les Levine
Systems Burn-off X Residual Software 1969

The 33 photographs on exhibition were originally taken by the artist in March of 1969 during an excursion by New York critics and press to view the opening of the Cornell University "Earth Works" exhibition in Ithaca, New York.

In April, 1969, Les Levine exhibited 31,000 photographs consisting of 31 separate images, 1,000 copies each, at the Phyllis Kind Gallery, Chicago. Most were randomly distributed on the floor and covered with jello; some were stuck to the wall with chewing gum; the rest were for sale.

"Software is the programming material which any system uses, i.e. in a computer it would be the flow charts or subroutines for the computer program. In effect software in 'real' terms is the mental intelligence required for any experience. It can also be described as the knowledge required for the performance of any task or transmission of

Courtesy the artist

communication. They say, 'It's going to be raining tomorrow.' is software. All activities which have no connection with object or material mass are the result of software. Images themselves are hardware. Information about these images is software. All software carries its own residuals.

The residual may take the form of news, paint, television tapes or other so-called 'media'. In many cases an object is of much less value than the software concerning the object. The object is the end of a system. The software is an open continuing system. The experience of seeing something first hand is no longer of value in a software controlled society, as anything seen through the media carries just as much energy as first hand experience. We do not question whether the things that happen on radio or television have actually occurred. The fact that we can confront them mentally through electronics is sufficient for us to know that they exist. . . . In the same way, most of the art that is produced today ends up as information about art." L. L.

Artist exposes himself electronically

Les Levine
A.I.R. 1968-70

A.I.R. basically consists of a group of television sets in a museum which displays activity taped in my studio, showing museum visitors the artist in his natural environment. The images change position from monitor to monitor on a random basis.

I believe this brings the art process directly to the public environment and thereby makes a closer connection between art and general culture.

*Note: Les Levine's original proposal consisted of constant direct coaxial transmission from his studio for the duration of the exhibition. This approach was abandoned when it was found that line-of-sight transmission was impossible.

Les Levine
Wire Tap 1969-70

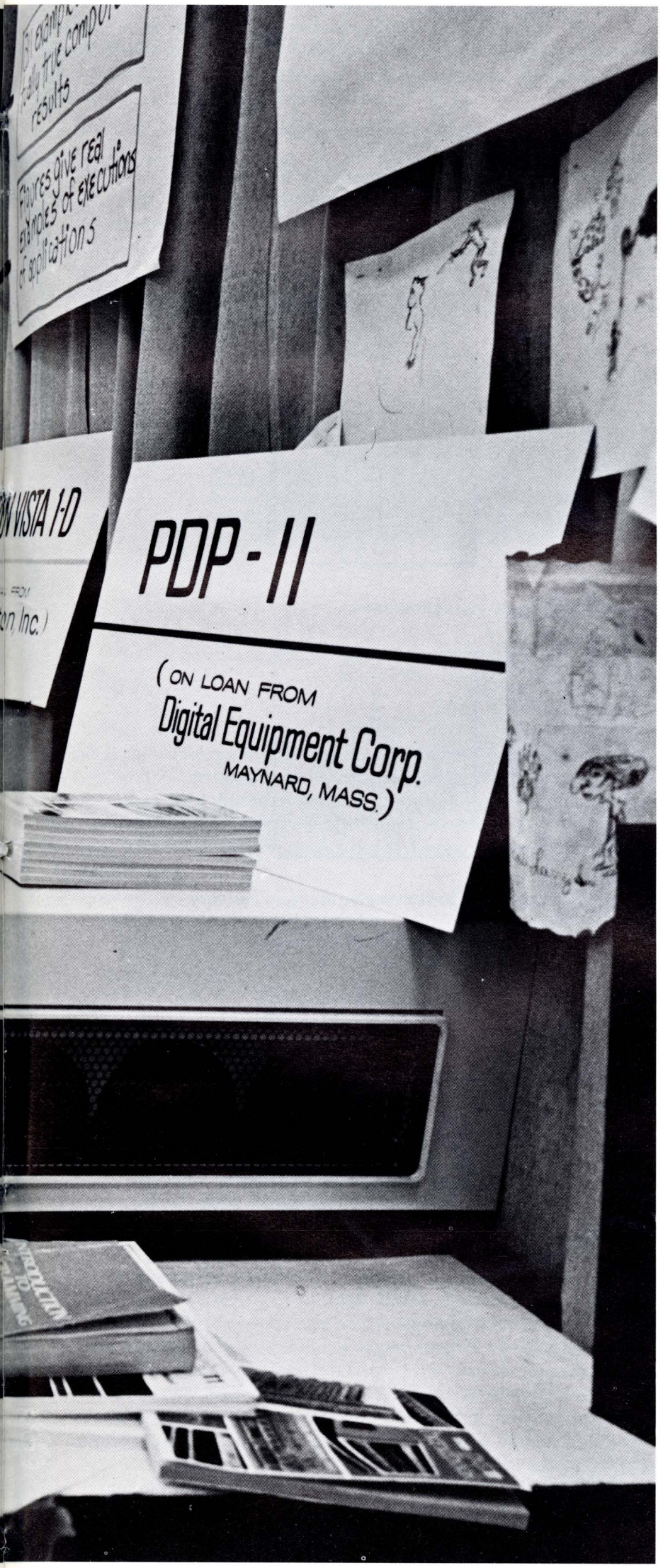
Wire Tap is a series of twelve speakers, each measuring 12″x12″, and containing a series of conversations between myself and anyone who telephones me during the day. People will hear these conversations as they pass by them.

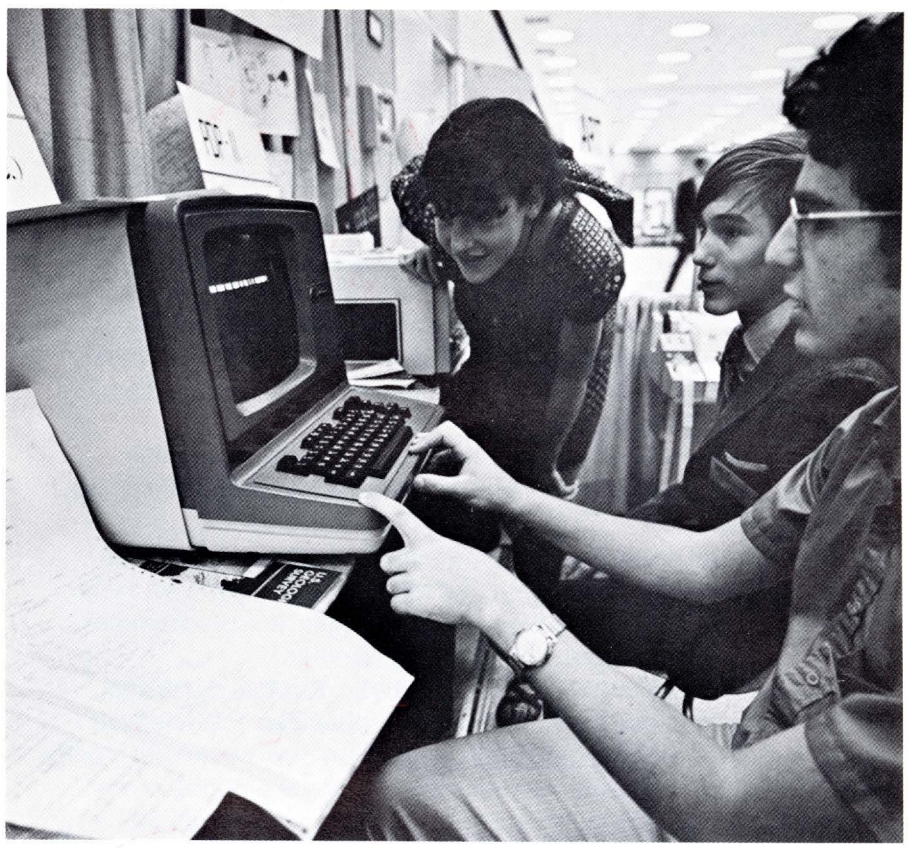
New generation of whiz kids

The R.E.S.I.S.T.O.R.S.* are a group of students form the Princeton, N.J. area who are whizzes with computers. In their barn headquarters, they do highly technical work with five computers which they either own or use on loan. They have exhibited in the last three Spring Joint Computer Conferences. Their enterprising spirit was the highlight of one conference where, during a strike when no telephone equipment was available, they successfully managed to activate their display by hooking into a pay telephone.

At the 1970 Conference, they set a precedent by giving the first student technical talk, which drew the largest audience of the entire conference program. They will soon publish a primer on computer language (Trac).

*Radically Emphatic Students Interested in Science, Technology and Other Research Studies





Computers are not what you think

(Condensed from Theodor H. Nelson, *The Computer,* to be published)
© 1970 The Nelson Organization, Inc.

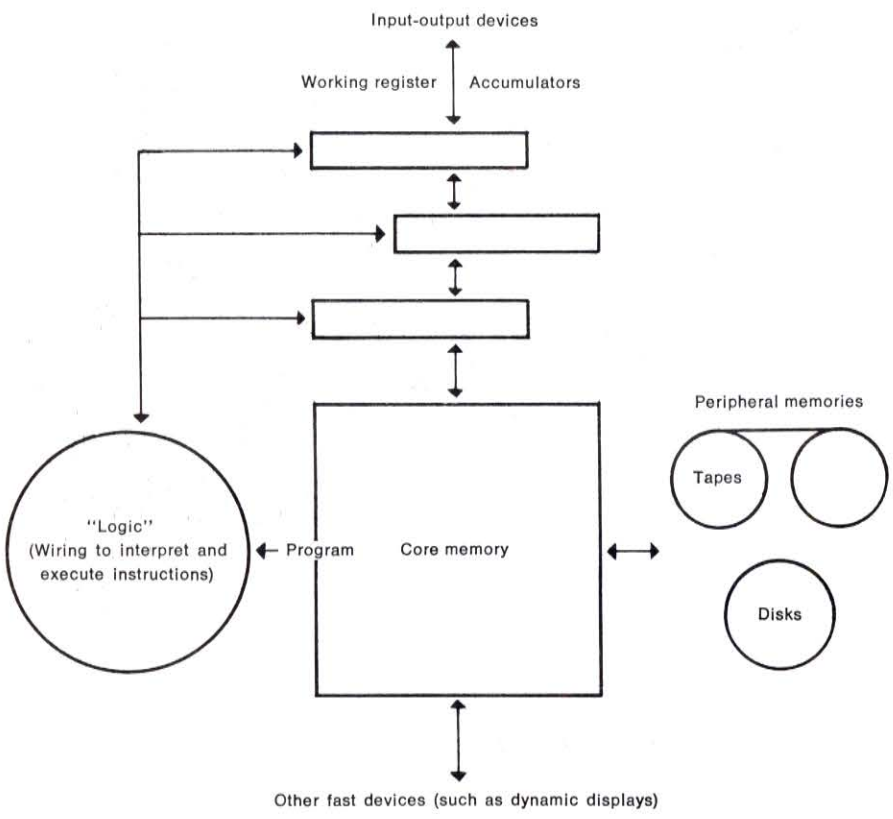
What is a digital computer?

A Digital Computer has the wrong name to begin with. John von Neumann, at the very beginning (late forties), called it the All-Purpose Machine, and that was the right name, but it got mislaid somewhere. A digital computer is a device which can be programmed to move information, shuffle information, receive information, send information, test information, make decisions (on the basis of its tests), quit what it's doing and start something else; perform long chains of activities made up of the above; and carry out necklaces of activities, each bead of which is one of the above chains.

People who understand how to select a computer's commands, combining and interrelating the machine's corresponding actions, are called *programmers.*

(People who use computers in some way, through programs with whose details they are not involved, are *users.* Not everyone who sits at a computer-connected device, such as a display, is a programmer. Soon most of us will be users, in one way or another.)

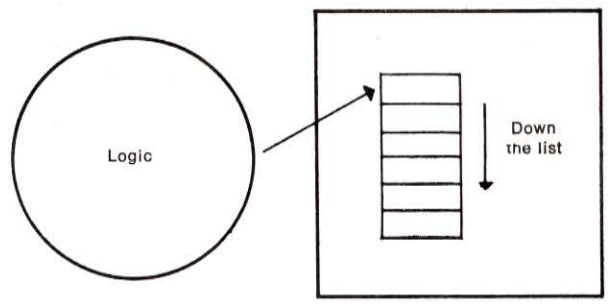
Computers can also count, and do arithmetic. But this numerical activity of computers has been vastly overemphasized. For it is their ability to vary and combine programs, test the outside world and modify it (through input and output), and handle the general diddling of vast quantities of information—such as storing it and printing it, as well as doing arithmetic on it—that makes it, in some very important sense, the ultimate machine.



A computer system ordinarily has four kinds of parts: *logic, registers, memories,* and *I-O devices.*

Logic is the wiring that causes the computer to respond to its instructions (or other events in the system).
A *register* is where something happens to information.
A *memory* is where nothing happens to information. (It stays there unchanged till requested.)
An *I-O device* is something which sends information to the computer (I is for Input) or gets information from the computer (O is for Output), or both.

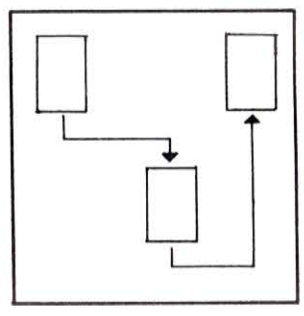
A *program* is ordinarily made of a series of patterns temporarily stored in the computer's main memory, or core memory. These patterns are *commands* to which the computer is wired to respond. They are in lists consecutively located in core memory.



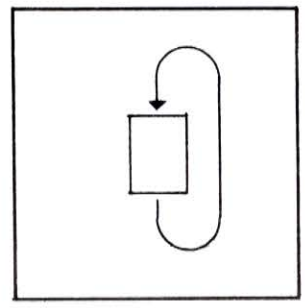
One at a time the commands are drawn from the program list into the specifies.
For instance:

test whether a register contains the same pattern as a certain location in memory.
send the contents of a register to a particular I-O device.
receive a message from an I-O device into a register.
move the contents of a particular memory location into a register.
move the contents of a register into a memory location.
add one to the contents of a register. And so on and on.

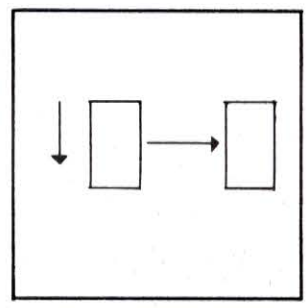
Programs stored in different parts of memory can be chained together,



or repeat themselves, as incantations,



or operate on blocks of data stored elsewhere in memory:



and much more. For instance, computer programs can summon other computer programs, which in turn—ah, never mind. Programming is creating the garlands, diadems and crosswords of instructions that make things happen.

A computer *language* is usually a set of artificial words (usually gritty-looking ones like MUL, ZONK, SNR, GLB) which a programmer may combine by some set of rules into a long spell (a program). This spell is then given in some way to another program in the computer, the "language processor", which turns the relatively few instructions in the computer language into the many ittybitty instructions needed by the computer itself. If the spell is properly cast, the system does what the programmer wants, either directly or through *more* programs ground out by the language processor.

There are thousands of languages, with different but overlapping purposes, some for arithmetic, some for text handling, some for pictures, but the majority indescribable in everyday terms. Well-known languages include FORTRAN, COBOL and ALGOL, but there are also

SNOBOL, TRAC, SIMSCRIPT, JOVIAL AND LISP. All of these languages have their jealous creators, guardians and partisans, for each language represents not just a kind of work to be done, but most likely a philosophy, an outlook, a way of handling problems in general.

Programming is creating and arranging instructions for machines and languages that already exist. Computer architecture is designing registers, instructions and logic. Software design means making languages and giant programs. Systems analysis is working out good ways to do things, with or without computers. Computer science is all these things.

The reader may observe that the possible complications are endless, but they are not unruly, they are quite fascinating, and they are not necessarily hard for ordinary people to understand. The technicalities are unavoidable; and the world is already sharply divided between those who know them and those who do not. The latter are at a disadvantage, and will remain so.

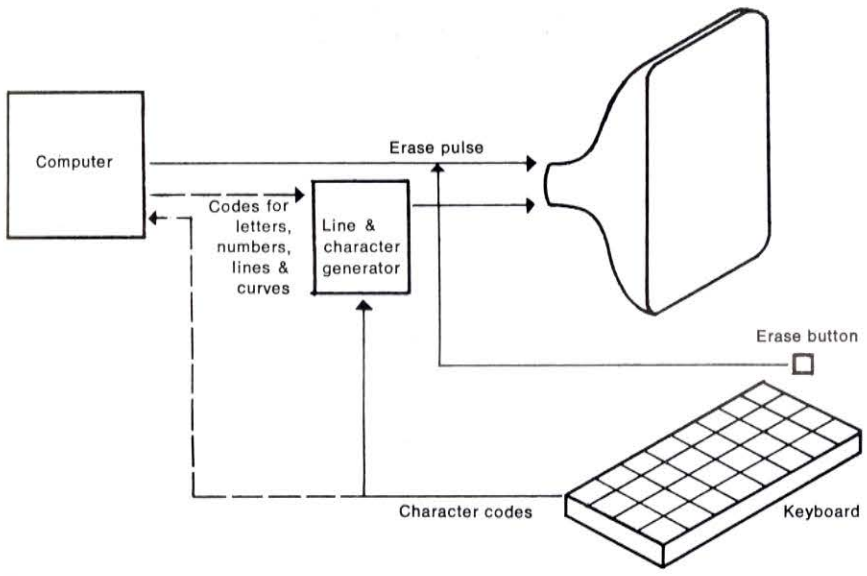
What is a computer display?

Static computer displays

1. Storage keyscope

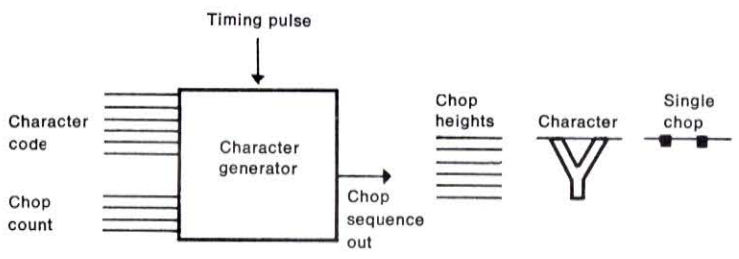
A presentation is sent slowly to this display from the main computer.

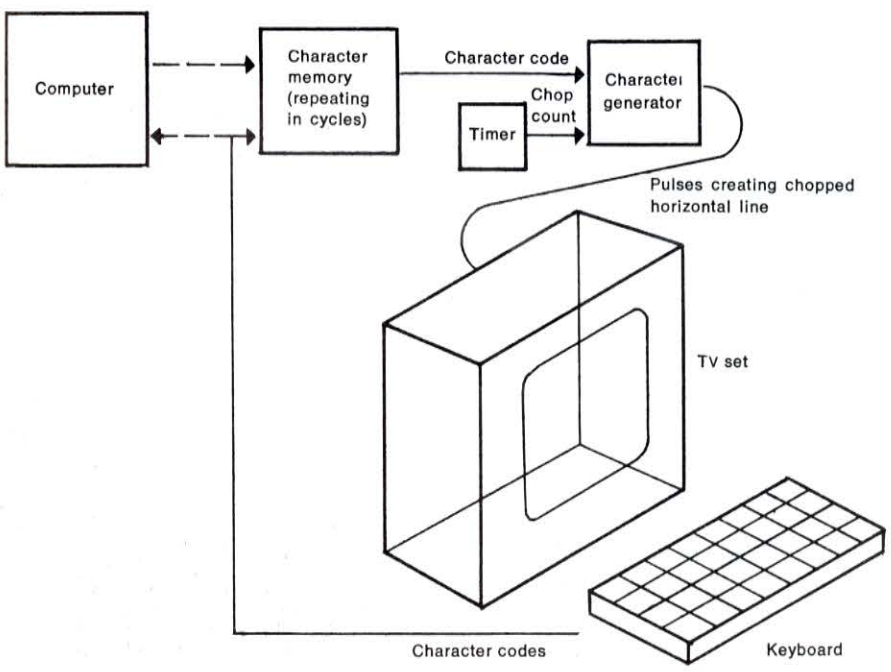
The storage tube holds the presentation until it is erased; a new presentation must be put on it from scratch.



2. TV keyscope

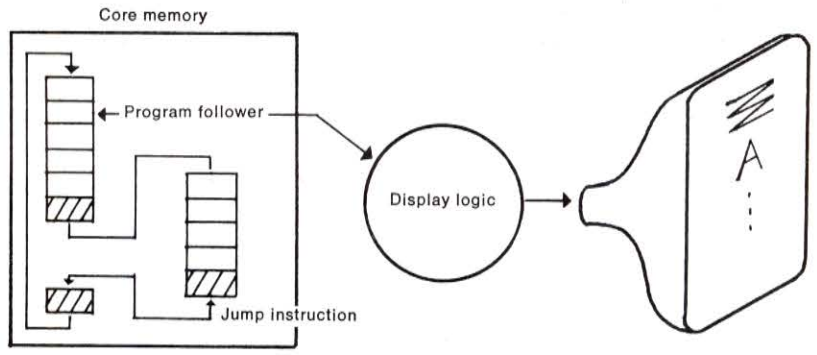
In this display, the contents of the screen are held in a local memory. In sync with the incessant television scanning beam, each character code goes to a TV character generator, which then sends out the appropriate blips to "chop" a single character at the beam's present height. Then on to the next, and so on; at the end of a line advance the chop count.





Dynamic computer display

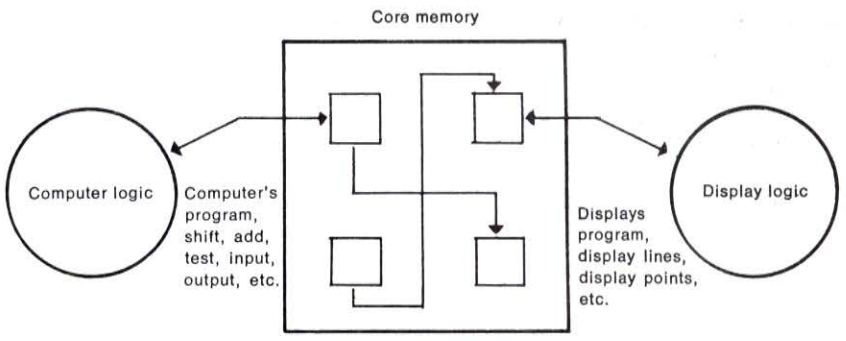
In this display, display logic (like the computer's) pulls display commands, one at a time, from a display program in a core memory. The commands in the sequence are interpreted by the display logic as successive moves of a tiny point of light on a screen, the tip of an electron beam being switched, rapier-like, around the screen's surface. When it finishes it starts over. (If the display program gets too long, it starts to flicker.)



Display program (simplified and translated)

Draw line
Draw line
Draw line
(Move beam)
Plot point
Plot point
(Move beam)
Write letter
Write letter
Write letter
(Move beam)

A high-power display ordinarily, these days, uses the core memory of a small general-purpose computer. Both can use the same memory intermittently, each program unbeknownst to the other.


Core memory
Computer logic
Computer's program, shift, add, test, input, output, etc.
Displays program, display lines, display points, etc.
Display logic

However, customarily this is wired up so that the display can summon the computer when something has to be done that the display's own program and logic cannot handle. The computer then sets aside its current program, and goes to its help-the-display program. This may be needed just to keep the display going, to help the user interact with the display in some way that is prearranged in the program (to recognize a user's request to draw a line, for instance), or to actually make some numerical calculation related to the display (for instance, a program for the computer to calculate the area of a rectangle showing on the screen.)

In display programming, we use the combined abilities of both the display logic and the computer logic. (How they interact will depend on the particular equipment.) But we can create programs, for instance, to create a stick figure, and by repeating this program at different locations, fill the screen with paper dolls.

Ways to program a display system to respond to user actions, or to time a presentation and show "movies", must here be left to the reader's imagination.

(Note: a good article on computer displays by Ivan Sutherland will be found in the June 1970 issue of the *Scientific American*).

Joseph Kosuth
The Seventh Investigation (Art as Idea as Idea)
Proposition One 1970

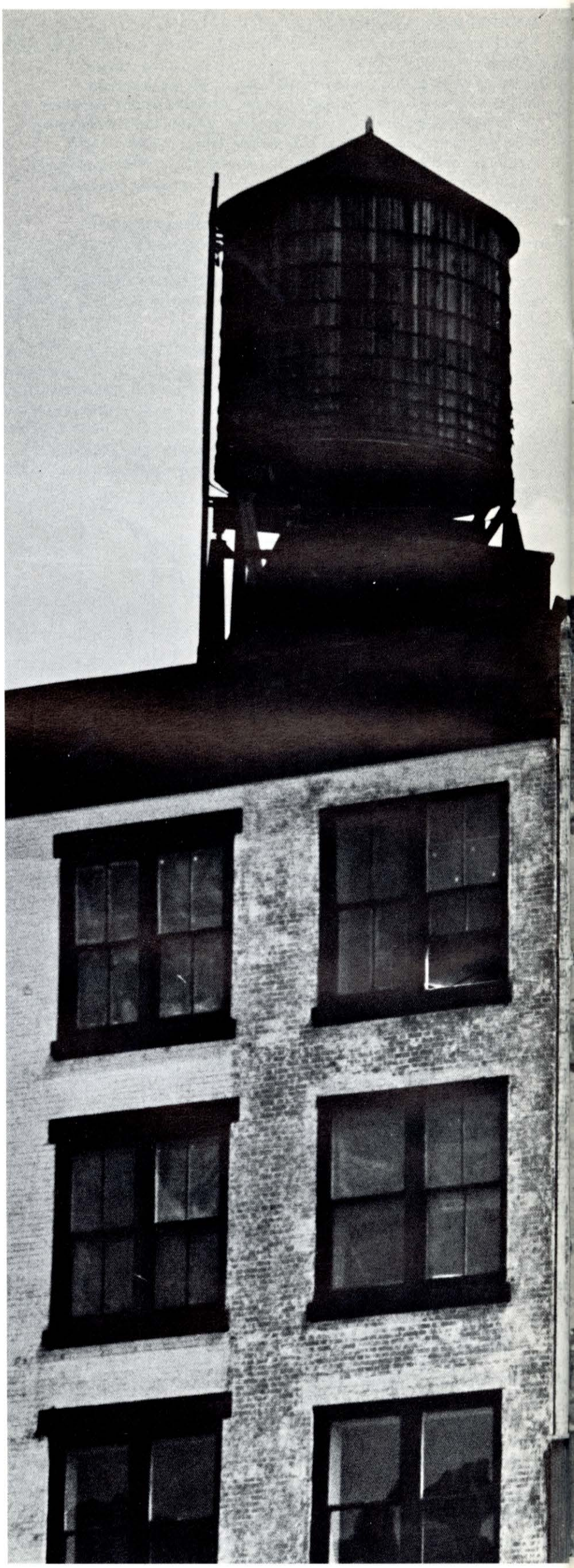
Form of presentation: One paragraph of text, ambiguous in meaning, will be placed in four contexts: billboard in Chinatown, New York City (in English and Chinese); advertisement in *The Daily World;* a banner in Turin (in Italian); temporarily in The Museum of Modern Art's *Information* Exhibition.

Museum presentation installation: One area will be filled in the following manner—On the walls will be photographic blow-ups of each section of the proposition's form of presentation, and on a table will be placed an assortment of information relevent to the work.

While certainly some of the elements I use in my investigations are of more importance than others, it is not possible to construct a mental image or 'icon' from the elements used—as you could in my work of a couple years ago. The elements I use in my propositions consist of information. The groups of information types exist often as 'sets' with these sets coupling out in such a manner that an iconic grasp is very difficult, if not impossible. Yet the *structure* of this set coupling is not the 'art'. The art consists of my action of placing this activity (investigation) in an art context (i.e. art as idea *as idea*).

The specific quality of the items used in a form of presentation and in a museum presentation installation are of a temporal nature directly related to taste. In other words it is necessary for me to choose a particular way *at this time* which is neither 'important' in its own right, nor deliberately 'unimportant' in an *arty* manner. This problem exists because of the still prevalent belief that there is a conceptual connection between art and esthetics—thus it becomes assumed that there is *artistic* relevance to my choices based on taste. Fifty years from now if my idea of art is extant it will be so only through the activities of living artists, and the taste I showed in my choices of the installation for this show will be dated and irrelevant.

Chinese translation and graphics by H. Kwan Lau.



FOSTER and KLEISER

1 to assume a mental set voluntarily. 2 to shift voluntarily from one aspect of the situation to another. 3 to keep in mind simultaneously various aspects 4 to grasp the essential of a given whole; to break up a given whole into parts and to isolate them voluntarily. 5 to generalize; to abstract common properties; to plan ahead ideationally; to assume an attitude toward the 'mere possible' and to think or perform symbolically. 6 to detach our ego from the outer world.

(一)心智自動・(二)應事自變・(三)內心同念各事・(四)握基本主要；分解主体和孤立各小節・(五)綜合；消去相同点；先備理念；意向專一，而思考或形行・(六)除世俗之自我观念・

FOSTER and KLEISER

Try something better.

J&B

RARE SCOTCH

PIENSTAMOS

Artists

Acconci, Vito, Born 1940, Bronx, N.Y. Lives in N.Y.C. Education: Holy Cross, A.B.; University of Iowa, M.F.A. Currently teaching at the School of Visual Arts, N.Y. One man exhibition at Gain Ground Gallery, N.Y., 1970. Group Exhibitions: Dwan Gallery, N.Y., "Language III", 1969; Seattle Art Museum, "557087", 1969; Vancouver Art Gallery, "955000", 1970; Oberlin College, "Art of the Mind", 1970. Street Works, N.Y.C., 1969. Performances at New York University, Wesleyan University, Rhode Island School of Design, Paula Cooper Gallery, N.Y., Hunter College, Wadsworth Atheneum.

Antin, David, Born 1932, New York. Lives in Solana Beach, Calif. Education: science and language studies; graduate work in linguistics. Occupation: poet, or artist working in language, art critic, Director of the Gallery for the University of California at San Diego, where he is a member of the Visual Arts Department. Currently working on a film exploring the relations between intermittently overlapping sound track and image sequences, a set of scenarios for dancers and actors, a volume of "poems" called *Meditations* (to be published by Black Sparrow Press in September 1970), and a book on Art and Technology for Viking Press.

Baldessari, John, Born 1931, National City, Calif. Lives in National City, Calif. Education: San Diego State College, B.A. 1953, M.A. 1957. Assistant Professor, University of California, San Diego, 1969-70; Professor, California Institute of the Arts, L.A., 1970. One man exhibitions: La Jolla Museum of Art, Calif., 1960, 1966; Southwestern College, Chula Vista, Calif., 1962, 1964; Molly Barnes Gallery, L.A., 1968; Eugenia Butler Gallery, L.A., 1970; Richard Feigen Gallery, N.Y., 1970.

Barry, Robert, Born 1936, New York City. Lives in N.Y.C. Education: Hunter College, B.F.A., M.A. Currently teaching at Hunter College. Selected recent exhibitions: Seattle Art Museum, "557087", 1969; Vancouver Art Gallery, "955000", 1970; The New York Cultural Center, "Conceptual Art and Conceptual Aspects", 1970; "20 Paris IV", 1970; Gallery Closing: "Art and Project", Amsterdam, Dec. 17-31, 1969; Sperone Gallery, Turin, Italy, Dec. 31-Jan. 8, 1969-70; Eugenia Butler Gallery, L.A., March 10-21, 1970. Untitled piece published by Gian Enzo Sperone, Turin, 1970.

Bradner, Scott, Born 1944, Sharon, Penna. Lives in Boston. Education: Boston University, 1960-64, 1966. Researched in cancer and air pollution, 1965, Children's Cancer Research Foundation. Experienced in all phases of programming, electro mechanical hardware design, and personnel management. Currently manager of Computer Based Lab, Psychology Department, Harvard University.

Burgy, Donald, Born 1937, New York City. Lives in Bradford, Mass. Education: Massachusetts College of Art, 1955-59; Rutgers University, 1961-63. Currently teaching at Bradford Junior College. Selected group exhibitions, 1969: Paula Cooper Gallery, N.Y.,"Number 7"; Dwan Gallery, N.Y., "Language III"; Städtisches Museum, Leverkusen, Germany, "Concept Art"; Seattle Art Museum Pavillion, "557087"; Vancouver Art Gallery, "995000"; Kunsthalle, Bern; "Art After Plans"; New York Cultural Center, N.Y., "Conceptual Art and Conceptual Aspects".

Conly, Paul F., Born 1944, Sacramento, Calif. Lives in Colorado, Boston, and N.Y.C. Education: University of Colorado, 1962-66; Signal Radio-T.V. Career School, Denver, 1965. Composer-performer-producer. Made record albums with Lothar and the Hand People, performing internationally in concerts and on U.S. and European television, composer of television and radio commercials and music for Sam Shepard's "The Unseen Hand," off-Broadway.

Denes, Agnes, Born Budapest, Hungary. Lives in N.Y.C. Education: City College, New School for Social Research, Columbia University. Awards: Alfred P. Cohen Art Scholarship 1961-62, John J. Myers Art Scholarship 1959-63, The M.L. Robinson Scholarship from Columbia 1964-66. Selected exhibitions: "Exposition Intercontinentale de Monaco", New York, Athens, Deauville, Monaco, 1967-68; International Art Show, United Nations, 1967; Ruth White Gallery, N.Y., 1969, 1970; National Academy Galleries, 1970; Dwan Gallery, N.Y., 1970.

Enzmann, Robert Duncan, Born in Peking, China. Lives in Lexington, Mass. Education: Harvard University, B.A.; Royal University of Uppsala, Sweden, Ph.D. Affiliated with Northeastern University, Boston, and Raytheon Corp.

Fernbach-Flarsheim, Carl, Born 1921, Germany. Lives in N.Y.C. Education: Illinois Institute of Technology, B.S. and M.S. in Art Education 1961. Artist and lecturer in Intermedia, Concept Art, computer–generated works. Selected group exhibitions: Kunsthalle, Bern, "Art After Plans", 1969; Dwan Gallery, N.Y., "Language III", 1969; Brooklyn Museum, N.Y., "Some More Beginnings", 1968; Kornblee Gallery, N.Y., Concrete Poetry Exhibition, Winter 1966/67. Selected publications: *Conceptual Cloud: Game, Book 1,* Cypher Press, Phila., 1967; *Conceptual Cloud: Game, THE BOOLEAN PACKAGE,* University Press, N.Y., 1969.

Giorno Poetry Systems, (n. John Giorno), Born 1936, N.Y.C. Lives in N.Y.C. Education: Columbia University, B.A., 1958. Worked as a seaman on freighters, was a stockbroker and is the man sleeping in Andy Warhol's movie *Sleep.* Works: *Dial-A-Poem* at The Architectural League of New York and The Museum of Contemporary Art, Chicago; ESPE (Electronic Sensory Poetry Environments). Books: *Poems by John Giorno,* Mother Press, 1967; *Balling Buddha,* Kulchur Press, 1970. Anthologies: *The World Anthology,* Bobbs-Merrill, 1969; *An Anthology of New York Poetry,* Random House, 1970. LP record *Raspberry & Pornographic Poem,* Intravenus Mind, 1967.

Goodyear, John, Born 1930, Los Angeles. Lives in Lebanon, N.J. Education: University of Michigan, Master of Design, 1954. Currently teaching at Douglass College, Rutgers University, and a Fellow of Visual Design Center, M.I.T. One-man exhibitions: Amel Gallery, N.Y., 1964, 1965, 1966. Selected group exhibitions: Museum of Modern Art, N.Y., "The Responsive Eye", 1965; Whitney Museum of American Art, "400 Years of American Art", 1966; Walker Art Center, "Light, Motion, Space", 1968; Milwaukee Art Center, "Options", 1968; National Collection of Fine Arts, Washington, D.C., "Exploration", 1970.

Haacke, Hans, Born 1936, Cologne, Germany. Lives in N.Y.C. Education: Staatliche Hochschule für bildende Künste, Kassel, 1956-60. Atelier 17 Paris, 1960-61. Fulbright Grant, Temple University, 1961-62. Currently teaching at Cooper Union, N.Y. Selected one man exhibitions: Galerie Schmela, Düsseldorf 1965; Howard Wise Gallery, N.Y., 1966, 1968, 1969; M.I.T., 1967. Group exhibitions 1969: Cornell University, "Earth Art"; Kunsthalle, Bern, "When Attitudes Become Form"; Seattle Art Museum, "557087"; Art Gallery of Ontario, Toronto, "New Alchemy"; Kunsthalle, Düsseldorf "Prospect 69".

Huebler, Douglas, Born 1924, Ann Arbor, Mich. Lives in Bradford, Mass. Education: University of Michigan, B.S., M.F.A.; Academie Julien, Paris; Cleveland School of Art. Currently teaching at Bradford Junior College, Mass. Selected group exhibitions: *Xerox,* 1968, and *March,* 1969, published by Seth Siegelaub, N.Y., 1969; Kunsthalle, Bern, "When Attitudes Become Form"; Seth Siegelaub, N.Y., summer show; Seattle Art Museum, "557087"; Kunsthalle, Düsseldorf, "Prospect 69", 1970; M. Claura's "Paris IV 70" and L. Lippard's "Situations" (in *Studio International, Summer*).

Kaprow, Allan, Born 1927, Atlantic City, N.J. Lives in Pasadena, Calif. Education: New York University, B.A., 1949; Columbia University, M.A., 1951. Currently teaching at California Institute of the Arts. Since 1958, has executed more than 50 Happenings, sponsored by such institutions as The Museum of Modern Art in N.Y., The Museum of Contemporary Art in Chicago, The Walker Art Center, The Theater of Nations in Paris and the Edinburgh Festival. Retrospective exhibition: The Pasadena Art Museum, 1967. Author of *Assemblage, Environments and Happenings,* Harry N. Abrams, Inc., N.Y., 1965.

Kosuth, Joseph, Born U.S.A. Lives in N.Y.C. Currently teaching at The School of Visual Arts, N.Y. American Editor of Art & Language Press, England. Selected Exhibitions: Gallery 669, L.A., 1968; Bradford Jr. College, Mass., 1968; Douglas Gallery, Vancouver, B.C., 1969; Instituto Torcuato Di Tella, Buenos Aires, 1969; Nova Scotia College of Art, 1969; Coventry College of Art, England, 1969; "Art and Project", Amsterdam, 1969; Galleria Sperone, Turin, Italy, 1969, 1970; Pinacotheca, St. Kilda, Australia, 1969; Leo Castelli Gallery, N.Y., 1969; The Art Gallery of Ontario, Toronto, 1969-70; The Pasadena Art Museum, 1970.

Levine, Les, Born 1935, Dublin, Ireland. Lives in N.Y.C. Education: Central School of Arts & Crafts, London. Selected one-man exhibitions: Art Gallery of Ontario, Toronto, 1966; Fischbach Gallery, N.Y., 1966, 1967, 1968, 1969; Museum of Modern Art, N.Y., 1967; Walker Art Center, 1967;

Architectural League of New York, 1967; Gibson Gallery, N.Y., 1968; New York City Department of Parks, 1969; Phyllis Kind Gallery, Chicago, 1969; University of Michigan, 1969; The Molly Barnes Gallery, L.A., 1969; Rowan Gallery, London, 1969; "Levine's Restaurant", N.Y., 1969. Publisher of *Culture Hero,* monthly newspaper, N.Y.

Nelson, Theodor H., Born 1937. Lives in N.Y.C. Education: Swarthmore College, 1959; Harvard University, M.A., 1963.Taught sociology at Vassar College, 1964-66. In charge of computer research at Harcourt, Brace & World publishers, 1966-67. Consultant to Bell Laboratories, 1967-68. Consultant to CBS Laboratories, 1968-69. Currently president of The Nelson Organization, Inc., N.Y.C., a small research and development corporation designing computer-controlled presentational systems.

Nolan, Jack, Born 1924, Lawrence, Mass. Lives in Lexington, Mass. Education: Boston University, B.A. in mathematics, 1952; M.I.T., M.S. in mathematics, 1953. Research in advanced development of computer information systems for the past fifteen years. Presently President of Massachusetts College of Art, Boston.

R.E.S.I.S.T.O.R.S. (Radically Emphatic Students Interested in Science, Technology and Other Research Studies) founded 1967. Bases in Hopewell, N. J. A self-educating coeducational group of Elementary School, Junior High and High School age members with their own PDP-Eight computer, donated by the Digital Equipment Corporation. Selected projects; sponsors of the first student technical session at the 1970 Spring Joint Computer Conference. Educational program for disadvantaged students from Trenton, N. J. Trac language primer to be published 1970.

Razdow, Allen M., Born 1946, N.Y.C. Lives in Allston, Mass. Education: Stevens Institute of Technology, N.J., 1964-66; Boston University; New School for Social Research, and New York University, 1966-67; Berklee School of Music, Boston, 1968. Composer-arranger, pianist, guitarist. Worked with jazz and rock groups. System level programmer, analog and digital hardware design. Experienced in bioelectronics, electro-optics, digital-analog systems. Currently system programmer at Harvard University Department of Psychology Computer Based Laboratory.

Schley Evander D., Born 1941, Montreal, Canada. Lives in N.Y.C. Attended Duke University. Filmmaker, affiliated with Great Balls of Fire, Inc., N.Y.C. Previous films: "The Les Levine Movie", "Place & Process", "Earth", "The Love Statue".

Sheridan, Sonia, Born 1925, Newark, Ohio. Lives in Wilmette, Ill. Education: Hunter College, A.B.; the California College of Arts and Crafts, M.F.A.; Columbia University; the Taiwan She Da University. Associate professor at the School of the Art Institute of Chicago. Numerous museum group shows, last one man show at the Rosenberg Gallery in Chicago in 1967. Most recent work in electric graphics.

Victoria, Theodosius W., Born 1942, Riverhead, N.Y. Lives in Montclair, N.J. Education: Suffolk County Community College, A.A.S.; State University at New Paltz, N.Y., B.S.; Rutgers University, N.J., M.F.A. Currently teaching at Newark State College. One man exhibitions: Loeb Student Center, N.Y.U., N.Y., 1967; Douglass College, N.J., 1968. Selected group exhibitions: Milwaukee Art Center, "Directions 1, Options", 1968; Rutgers University, "The Gun", 1968; Museum of Contemporary Crafts, N.Y., "Sound", 1969; "Form 1", Philadelphia, 1969.

Weiner, Lawrence, Born 1940, Bronx, N.Y. Lives in N.Y.C. One man exhibitions: Cratering piece, Mill Valley, Calif., 1960; Seth Siegelaub, N.Y., 1964, 1965; *Statements,* published by Siegelaub/Kellner, 1968; Konrad Fischer, Düsseldorf, 1969; Nova Scotia College of Art, Canada, 1969; Wide White Space, Antwerp, 1969; "Art and Project", Amsterdam, 1969; Galleria Sperone, Turin, Italy, 1969; *Terminal Boundaries,* published by Siegelaub (N.Y.C.)/König (Cologne) 1969-70. Yvon Lambert, Paris, 1970; *Traces,* published by Editions Sperone, Turin, 1970.

Woodman, Ned, Born 1950, Riverside, Calif. Lives in Cambridge, Mass. General purpose programmer and experienced in hardware; sailing enthusiast and sometime artist. Presently senior technical assistant at Computer Based Lab, Psychology Department, Harvard University.

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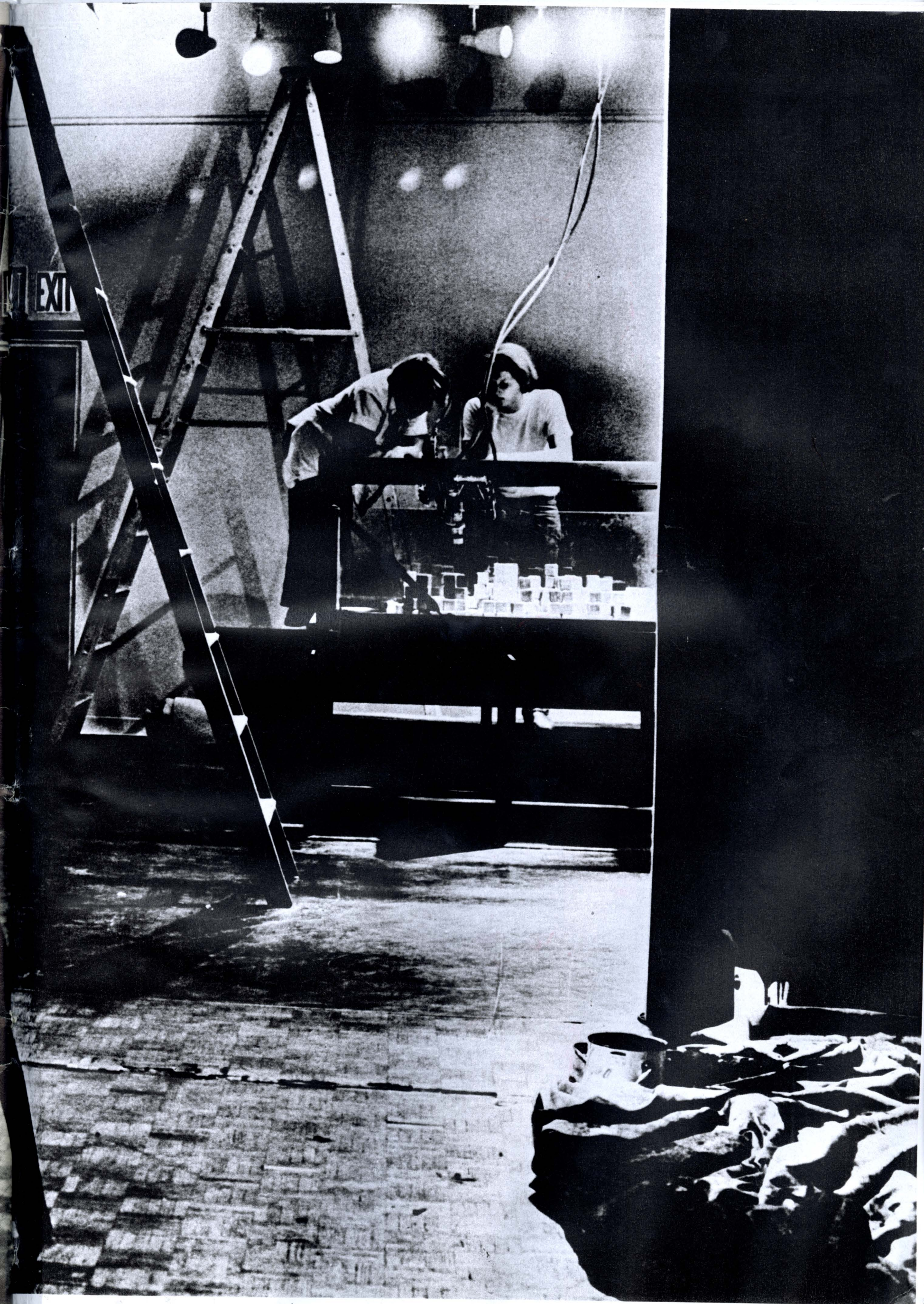
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